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THE MODERN BAKER CONFECTIONER & CATERER

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THE MODERN BAKER

CONFECTIONER AND CATERER

A CONFECTIONER'S ARTISTIC TEA ROOM

THE MODERN BAKER CONFECTIONER AND CATERER

A PRACTICAL AND SCIENTIFIC WORK
FOR THE BAKING AND ALLIED TRADES

EDITED BY

JOHN KIRKLAND

LECTURER AND TEACHER OF BREAD-MAKING NATIONAL BAKERY SCHOOL BOROUGH POLYTECHNIC INSTITUTE LONDON

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CHAPTER XXV

BRITISH SMALL BREADS: HOT-PLATE GOODS

In all parts of the kingdom there are certain kinds of small bread which find special favour. These are not so essentially different in the materials from which they are made as in the shape and condition of the crust. Among such small goods the English *muffin* may be first noticed. At one time these were sold by nearly every baker who professed to make small goods, especially in the winter months, but the art of manufacture has now been almost lost to the general trade, and has been specialized, so that muffin-baking has become a distinct trade, the ordinary baker buying daily supplies on wholesale terms. Muffins are essentially old-fashioned fare, and custom has now so much changed that they are not regarded as essentials on the tea tables of the present generation. This change of custom is responsible for the change in the trade. The ordinary baker sells so few that it is not worth his while to keep a hot plate for their manufacture. In provincial centres, and especially in country towns, the trade is still to a great extent in the hands of the ordinary baker, and considerable difficulty is frequently experienced in making them of the required lightness and the proper degree of holeyness.

English Muffins.

The following recipe and instructions will be found easy and safe. Weigh down 3 lb. of moderately soft flour and sift through it ½ oz. of bicarbonate of soda. Mix 1½ oz. yeast with 1 qt. of water at 105° F., and mix the flour into a tough batter and stand in a warm place for an hour or until the batter has risen and dropped; ¾ oz. of salt powdered is then stirred in until the batter is again toughened, and it is allowed to lie for 15 to 20 minutes more. Meanwhile ¼ oz. of cream of tartar is dissolved in about a gill of milk and gently mixed in the batter. It is then ready for dropping on the hot plate. The bad results so frequently obtained are generally due to the method of cooking. If the batter is in the least degree too stiff the muffins are certain to be "blind". The same result follows if the flour is too strong, especially in the case when the flour is stronger than that with which one is familiar. It is better always to try one muffin first before filling the hot plate. Then if that fails to hole properly add a little more water or milk, or if it is too thin and has no substance, but runs out under the rings, a little flour may be added, but it is better if possible to avoid these additions after the batter is ready. The hot plate should be very hot and thoroughly well cleaned but not greased. The rings should be greased and placed in position on the plate and the same quantity of batter dropped in each with a small mould or ladle. As soon as the exposed part is covered with holes the rings are lifted off, and with a palette knife the muffins are turned and baked on the holey side. They should be golden-brown on the side first towards the plate, but only browned enough on the holey side to remove

Recipe for Muffins.

the sickly appearance they have when quite white. When done they should be light but tough, and although sufficiently cooked it is not intended that they should be eaten without previous toasting. In a good many districts *picklets* is the name given to what are called *muffins* in others.

Coke Hot Hearth.

There are now a good many types of hot plates on the market as compared with ten or twelve years ago. The old hot hearth was a thick iron plate, under which there was a long coke fire that required a good deal of care if the plate was to be kept evenly heated over its entire surface; and whatever care was exercised there were sure

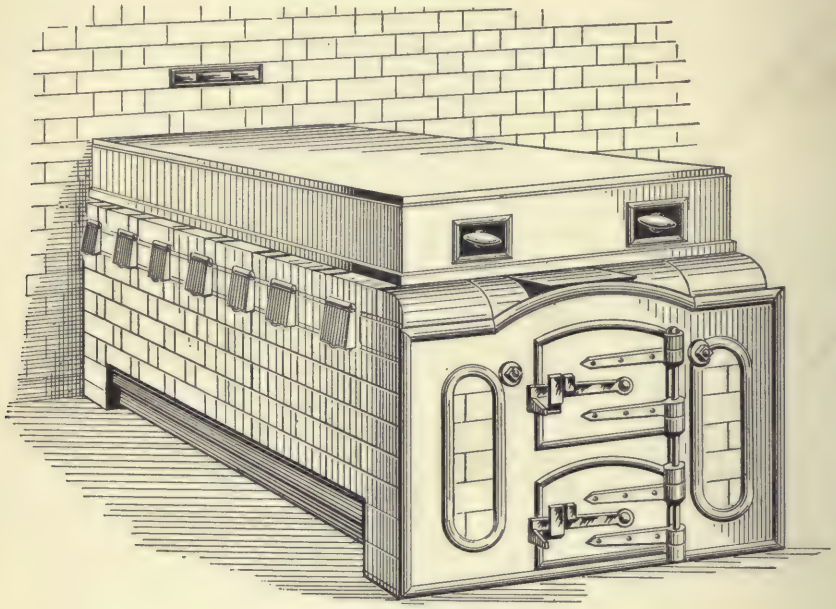


Fig. 11.—Coke Hot Plate

to be differences of heat at any one baking, whilst the plate was always liable to become cool unexpectedly unless the fire was carefully watched. There are still a good many of these old-style plates in use, but a modified form has recently been patented by Mr. Smith of Edinburgh, in which the coke fire can be regulated at different parts of the plate by means of dampers (fig. 11). This plate is said to give excellent results with a comparatively small quantity of fuel; but where the quantity of hot-plate goods to be baked is small the ordinary gas hot plate (fig. 12) is much more convenient. This has a thin plate, and the heat is supplied as wanted by several rows of atmospheric burners placed a little distance underneath. The advantages of the gas hot plate are, that it requires to be heated only a few minutes before it is required, and by means of one tap the amount of heat can be accurately regulated, whilst so long as the burners are clear the heat over the plate is comparatively uniform.

Gas Hot Plates.

The cost for heat is slightly greater than when a coke fire is used, but the cleanness and convenience more than compensate for this extra cost. The

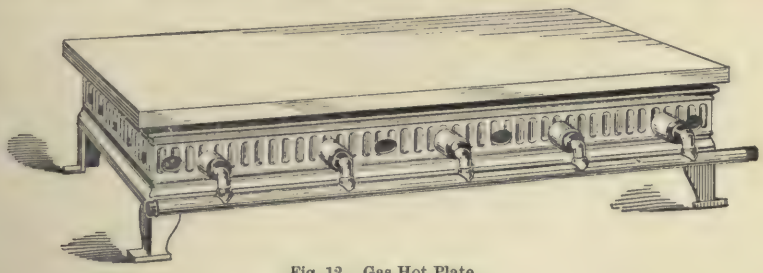


Fig. 12.—Gas Hot Plate

most modern expedient for heating a large hot plate is by means of a series of sealed steam pipes (fig. 13), somewhat similar to those used in the steam-

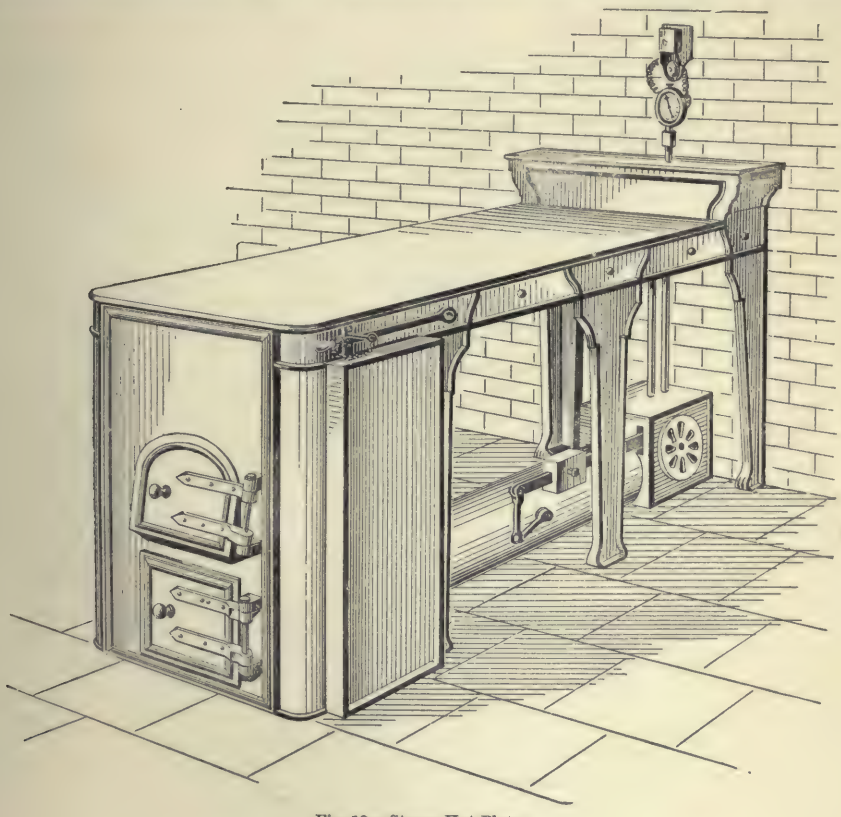


Fig. 13.—Steam Hot Plate

pipe oven. There is a very essential difference, however. In oven pipes the internal pressure can only be assumed from the heat registered by the thermometer, but in the case of hot-plate pipes they are connected with an ordinary pressure gauge which shows the

Steam-pipe Plates.

pressure of the contained steam, and which rings an alarm as soon as the danger point is reached. The good points about plates heated by this method are—that they cost little for fuel, are of almost uniform temperature all over, can be easily regulated, and are capable of baking continuously even when a large quantity of hot-plate goods is required.

Muffins are usually associated in the public mind with *crumpets*, which are also hot-plate goods, but are different in almost every respect from the muffins described above. Crumpets are thick, extremely light, fermented dough cakes that are not holey nor tough, and which can be eaten cold or hot as desired. For these cakes the following method may be used. Weigh 5 lb. moderately strong white flour. Make this into a very soft dough with 2 pt. water and 1 pt. milk, the temperature of both being 104° F.; 1 oz. salt, ½ oz. sugar, and 2 oz. yeast. The dough should be made as tough as possible by much mixing on the table, and then placed in a warm place to prove for one hour. At the end of that period it is again kneaded thoroughly, the hands being kept free from the soft dough by dipping them from time to time in a little warm water. This dough is allowed to lie for another hour, and then divided into pieces about 2½ oz. each for single crumpets. The softness of the dough makes scaling of these pieces extremely awkward; so the usual method is to squeeze the dough through a ring made by the thumb and forefinger of one hand. This has the effect of producing a kind of round ball of dough, which is broken off when large enough by the other hand, and dropped on to a proving board very thickly covered with flour or cones. When this board is full it is best to cover it with a similar board, and the latter with a cloth, and put them in a warm place for about thirty minutes. In cold weather the proving board or drawer should itself be heated before the crumpets are placed on it. The pieces will spread slightly, but will still show a more or less rounded appearance when quite proved. They are baked on a plate only moderately warm, the side that was uppermost on the board being placed downward on the plate. When done on one side they are turned over on to the other. This expedient has the effect of making both sides of the crumpet about the same width when baked. It is not usual to bake these in rings, although this is sometimes done; and when that is the case, the rings are removed just after turning. The difficulty in baking these is the danger of their being underbaked in the centres, a condition likely to be produced if the plate is in the least degree too hot. When finished they should be about 3 in. in diameter and about 2 in. thick. They are sufficiently baked when an indent made gently with the finger on the soft part of the side springs back and leaves no mark. It is possible to make crumpets with stiffer dough than here suggested, in that case scaling the pieces and rolling in the usual way as for buns; but it will be found that when made in that way, while light enough, they are not so light as those made from the soft toughened dough just described, nor is the texture so open and flaky as in the latter, a condition considered characteristic of cakes of this sort.

English Crumpets.

Although hardly belonging to the bread section, it may be useful to describe here the method of making *Scotch pancakes*, which, though sweet and of richer colour, are not unlike English muffins in size and shape; and also to describe a method for what are called crumpets in Scotland, although these have nothing in common with English crumpets except the name, but are an imitation of English pancakes as made in kitchens on Shrove Tuesday. Scotch pancakes and crumpets are hot-plate goods. In poor neighbourhoods, or where the size sold for a halfpenny must be large, the mixture used is necessarily cheap, although, when fresh, the pancakes are not bad to eat. For a very cheap mixture the following method may be used. Into 4 lb. soft flour sift 1 oz. soda and 1½ oz. cream of tartar, and beat into a batter with 2½ pt. of buttermilk in which 1 lb. of soft sugar has been dissolved. Drop at once either from a small cup or a spoon on to the hot plate, previously well greased and moderately hot. While soft on the plate a few currants can be sprinkled on the top of each. As soon as the sides next the plate are coloured the cakes are turned over. When finished they should be about 4 in. in diameter and ½ in. thick, and both sides as nearly as possible the same breadth. Care has to be exercised to turn the cakes at the right time: if they are turned too soon they become much thicker in the centre than at the sides, and the centre is not sufficiently baked, whilst if they are not turned soon enough the top is much narrower than the bottom and they are spoiled in appearance. In good neighbourhoods a much better mixture is desirable, and may be as follows. Weigh 5 lb. soft flour—Hungarian if available—and sift into it 1½ oz. bicarbonate of soda and 3 oz. cream of tartar, 12 oz. lard, 1½ lb. sugar, and 6 eggs. This will require 2¾ to 3 pt. either sweet or butter milk, but the exact quantity depends on the strength of the flour. To obtain the best results the mixing should not be done in the ordinary scone-making way, but the lard should be first melted; the milk, eggs, and sugar are then well mixed together, and the prepared flour beat into this liquid to produce a tough batter. The melted fat is then gently but smoothly mixed with the batter, and the mixing is ready for dropping on the plate, which should be moderately hot and well greased. One advantage of mixing the fat last in the melted state is that the batter becomes a little firmer as it stands, while this method also seems to produce a shorter and freer-eating pancake than if the fat had been rubbed into the flour in the usual way. Some skill is needed in dropping them on the plate so as to ensure perfect roundness. If a spoon is used it should be held comparatively high above the plate, and as the mixture is forced out by the finger, it is really thrown on to the plate with a force sufficient to spread it a little. A simpler expedient to ensure roundness is to drop the pancakes from an ordinary savoy bag. The same rules as to turning and baking apply to the richer sort as to the cheaper described above, but greater care is required in dealing with the former. The usual size is about 3 in. diameter and ½ inch thick, the price being a halfpenny, but these make an excellent selling line for afternoon tea if made smaller

Scotch Pancakes.

and sold at three for a penny. They eat short and nice, not unlike a sponge or a piece of Genoa cake, but less rich. The addition of flavouring essences is optional, but they are satisfactory without, and much better in that state than made nauseous with an overdose of lemon or vanilla.

Scotch Crumpets.

For the thin Scotch crumpets the quantities are 5 lb. strong flour, through which 1½ oz. bicarbonate of soda and 3 oz. cream of tartar have been twice sifted; 2½ lb. sugar, 1 lb. lard, 8 eggs, and 5 to 5½ pt. milk. These are best made in the same way as pancakes, by mixing the eggs, half the milk, and all the sugar together, and first beating in all the flour. The fat is then added in a melted state, and then the remainder of the milk. The plate should be hotter than for pancakes, and must be well greased before each filling. As it is essential that the crumpets should be thin and holey and flexible when baked, it is as well to try one on the plate before starting the lot. A small ladle or cup is a suitable thing for dropping them. The soft upper surface should be quite covered with holes before they are turned over, and the colour is generally a good enough indication of sufficient baking. When done they should be about ⅛ in. thick and about 5 in. in diameter. They should be pliable enough to roll without cracking, and this result is best obtained when a tough strong flour is used. On Shrove Tuesday there is a good shop sale for these goods if dusted with sugar on which a little juice of lemon has been sprinkled. In Yorkshire and the Midlands of England small hot-plate cakes are made from a mixture consisting of 4 lb. flour, through which 1 oz. bicarbonate of soda and 2 oz. cream of tartar have been sifted. Into this 1 lb. of butter, or half butter and half lard, is rubbed, and a bay made. Into the bay 12 oz. sugar is weighed, and 12 oz. cleaned currants placed round the outside. Dough is made with 6 eggs and 1½ pt. milk. This makes a free soft dough, which, after standing a few minutes to lose its toughness, is rolled out about ⅓ in. thick and cut out with a cutter 3 in. in diameter. These are baked on the hot plate and turned when half done.

Girdle Scones.

Scotch *girdle scones* are conveniently baked on a hot plate. These are usually quite plain, but to make them satisfactorily requires some care. Into 8 lb. of very soft white flour 2 oz. of bicarbonate of soda and 4 oz. of cream of tartar are thoroughly sifted; some bakers also sift 1½ oz. of salt through the flour. Dough is made with about 3½ pt. of buttermilk either on the table or in a basin. Mixing, while being sufficient, should not be excessive, to cause the dough to become tough, and to this end it is a practice in some bakeries to mix the dough lightly with a stick in a basin, then to turn it out on a dusted board and knead very lightly. To obtain light scones it is necessary to have the dough as soft as it can be to handle. The size of the scones is determined by the custom of the locality. In some places the usual size is that sold for a halfpenny, each scone, which is the quarter of a round, weighing about 3 oz. In the north of Ireland, where soda bread of this sort is in great demand, the penny size is more common, the weight in this case

being from 8 to 10 oz. The plate must not be over hot or there is much difficulty in baking the scones in the centre, as they are usually made 1 in. or 1½ in. thick. It does not require to be greased. When baked on one side the scone is turned over gently and baked on the other side. The most convenient tool for readily turning the scones is a small piece of stick well sharpened at one end. If the flour available is rather strong and seems to produce tough scones, 1 oz. of lard to each pound of flour may be rubbed in, and this softens and shortens them to some extent, but it is better to secure very soft flour, and to depend on this and on light mixing to ensure that the scones will have the softness so much desired.

Under the name of *sweet milk scones* there is another variety made which some customers prefer. For these weigh down 8 lb. soft flour and sift twice through it 2 oz. bicarbonate of soda and 4 oz. cream of tartar; into this rub 12 oz. of lard. Dough is made much stiffer than for ordinary scones; so only about 3½ pt. of milk is required for this quantity, but 12 oz. of sugar and 1 oz. of salt are previously dissolved in it. Ordinary buttermilk may be used, and gives quite as good results as fresh milk. These scones are usually weighed at 8 oz. for four, and are sometimes sold in large flat rounds not more than ½ in. thick, or they may be cut into four in the usual way before baking. For these, on account of the sugar they contain, the plate must be only moderately hot; else they bake too dark in colour. In pinning out the rounds, the best plan is to pin each first only half the width it is desired, then, after it has lain a little, pin it out to the full size, which should be about 8 in. diameter, and then cut into four in the ordinary way, piling the scones on top of each other in fours until enough are done to fill the hot plate. A form of this kind of scone which at one time was common in Scotland, but made in private families rather than by bakers, contained the same quantity of aerating chemicals but no fat or sugar. In place of the latter 1½ oz. of golden syrup was used to each pound of flour. These are made in flat rounds about ½ in. thick, and are cut after being baked.

Sweet Milk Scones.

Syrup Scones.

The trade in *curled oatcakes* has now become much more an affair for the baker than formerly, when every Scottish housewife prided herself on the excellence of her oaten bread. Now a great deal is made in the large bakeries and biscuit factories, but there is nothing to prevent the small baker with a family connection holding this trade as his own. Oatcakes are best made from medium cut meal. For a small mixing use 3½ lb. of oatmeal free from bitterness, and thoroughly mix ½ lb. strong flour with it. Rub into this 2 oz. lard. Make a bay, and weigh into it 1 oz. of salt, and use warm water to make dough in which has been dissolved in the bay about ⅛ oz. of bicarbonate of soda—no cream of tartar. Make dough rather soft at first, as it will stiffen very much while lying to be made up. Scale off into pieces about 6 oz. each and mould round, then pin out smoothly until about ⅛ in. thick and about 8 in. in diameter. This is not quite easy for anyone not familiar

Curled Oatcakes.

with the work, owing to the edges breaking and the dough at the beginning being sticky. The edges must be kept as even as possible by pinching with the thumb and forefinger, and the dough kept from sticking by rubbing over on the top and underneath with a little dry meal. When enough are ready to fill the plate, they are neatly placed on it and baked on one side till nearly done, then turned over. Before they are sufficiently baked on the second side they will begin to curl slightly, and when this is the case they must be removed from the plate, or there is danger of producing a burned ridge along the back of each. Above hot plates specially adapted for oatcake work there is a rack fixed on which the oatcakes partially baked are placed, with the least-baked side towards the plate; in this position they are dried and more or less toasted by the heat radiated from the plate, and the process of curling is there completed. In the absence of such an arrangement it is sufficient to take the oatcakes from the plate, place them on a clean baking sheet, and dry them for a few minutes in an ordinary oven. Here, again, care has to be taken that they are not burned. The addition of a little flour to the mixture is only a baker's expedient to make them easier to handle; it is not used in home baking. The pinch of soda is to remove objectionable flintiness. The fat is for the same purpose, but some prefer oatcakes without any fat.

CHAPTER XXVI

BRITISH SMALL BREADS: OVEN GOODS

Very nice soda bread can be made without the use of a hot plate by baking either on baking sheets or on the oven bottom. For this purpose the mixture given first for plain scones is most suitable. The scones, weighing 2 lb. for four, are pinned out about ¾ in. thick, and then cut into four and glazed over with an egg wash consisting of half egg and half milk. After lying a little they are stabbed over in the centre with a skewer to prevent blisters, and baked on flat tins or in rows on the oven bottom. When properly set they are turned over, those on the oven bottom with a thin small bread peel, those on tins by drawing the tins to the mouth of the oven and turning the scones over one at a time. The only difficulty in dealing with goods of this sort is in watching the proper time to turn them. If this is done too soon the scones may be thin and close; if it is delayed too long the top is already set, and when turned the glazed portion only touches the hot tin at one or two points, and its appearance is spoiled; while neglect in this matter usually results in large hollow places under the skin. When properly made, this sort of soda bread, called in the north of Ireland *soda farl*, looks very bright, and sells well. It is about 1½ in. thick, and it eats freer than that baked on the hot plate, although that is the usual manner of baking.

Oven-baked Soda Bread.

Irish Soda Farl.

Every district has its peculiar kinds of morning or breakfast rolls. In England generally, and particularly in London, this is either a flat round cake or a small long roll made in batches on flat tins. The common practice is to make these from a piece of ordinary bread dough, but it is better, if any considerable quantity is required, to make a special dough for themselves. As they are wanted early it is not always possible to make a straight dough for them in the morning, unless in cases where the men start very early or work during the night. If it is possible to allow three hours before the rolls are wanted the following quantities may be used. For 20 lb. medium strong flour use 6 oz. yeast, 4 oz. salt, 3 oz. sugar, and 6 oz. lard or other tasteless fat. Make dough in the ordinary way with about 9 pt. of water at 104° F. This dough, kept in a warm place covered up for 1½ hour, should after a good kneading be ready for scaling into the sizes desired. Where there is any quantity made it pays to have a small dough-dividing machine (fig. 14), which cuts out 30 pieces at once from a weighed portion of dough. If small batched rolls are wanted these are simply moulded long and placed close together on a baking sheet with deep edges, or one with small wood upsets round the sides. The sheet and sides should be slightly greased, and the rolls when filled should be washed over with a little milk, and again when ready for the oven. These rolls will take quite half an hour to prove. If round bread cakes are made they are moulded round, pinned out to a little less than the width they are ultimately to be—because they spread a little—and washed over with milk or water. When sufficiently proved, and just before placing in the oven, they should be stabbed once or twice in the centre with a skewer, or indenting once in the centre with the finger will serve to prevent the blisters which are apt to form under the upper crust. A favourite shape of roll for which this dough is very suitable is that—generally about 3 oz. in weight—baked in a long round pan but open

Morning Rolls.

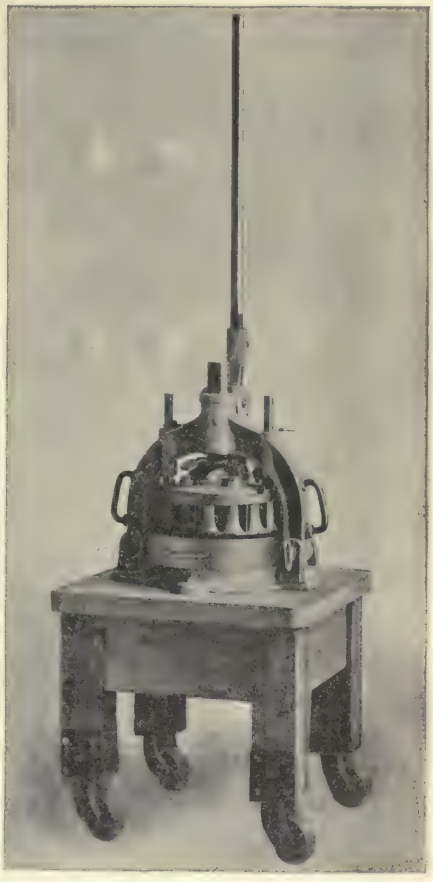


Fig. 14.—Dough-dividing Machine

Coffee-house Rolls.

at the top. These rolls are occasionally baked with a very hard crust, which is afterwards rasped off, the name *rasped roll* being in that case used. The same dough is very suitable for making the large flat loaves called in Yorkshire *bread* or *batch cakes*; only if to be used for this purpose it would require to stand in dough a half-hour at least longer than the time stated above, as these loaves present a drawn and unshapely appearance if the dough is in the least degree unripe when made up.

Rasped Rolls.

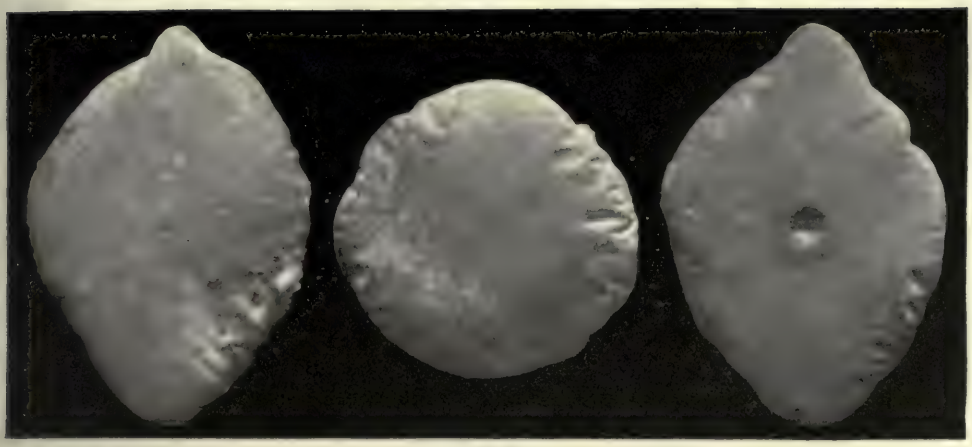
In cases where it is not possible to wait so long, speed of working can easily be obtained by simply increasing the quantity of yeast. No bad effects will follow, except of course the increase in cost. Good results are obtained, however, by making small bread from an overnight sponge, keeping that large in proportion to the total quantity of dough. For the same quantity of flour as that given above, the sponge would consist of 10 lb. flour, 1½ oz. yeast, 1 oz. salt, 1 oz. sugar, and 3 qt. water at such a temperature as will make sponge 76° F. This sponge will be a very soft dough, and it should be well toughened by kneading. The most suitable vessel in which to keep this sponge is a small tub, which should be scalded, and, while wet, thickly dusted with cones. This sponge may stand seven hours; or, if nine hours is a more convenient period, then 1 oz. of yeast should be sufficient. It will rise and fall twice in that time, and in the morning should require very little breaking down. Dough would consist of 10 lb. flour, into which 6 oz. lard had been rubbed, 3 oz. sugar, and 3 oz. salt, and 3 pt. water. This dough, given a rest for three-quarters of an hour, will be ready then for scaling and working up in any way desired.

Sponge for Rolls.

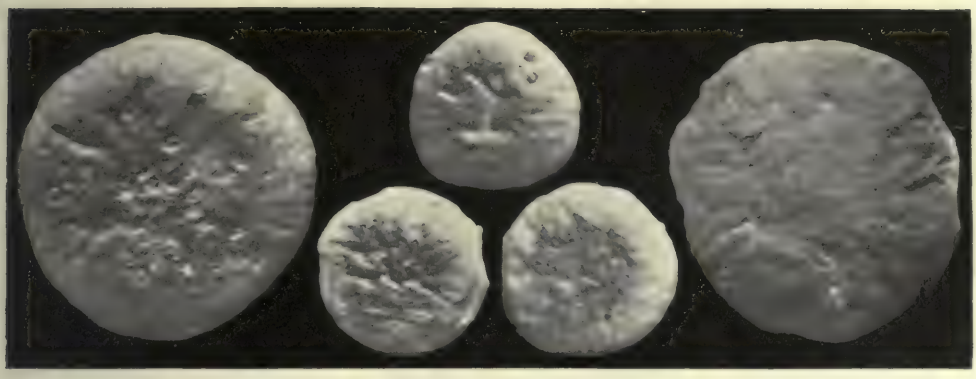
Some sorts of small fermented goods are made from stiffer dough than the above. Of this sort are the small biscuit-like cakes cut out with a cutter, docked in the centre, proved, washed over with milk, and baked, and sold as *nursery biscuits*. These may be stiffened by adding flour, and 1 oz. more sugar for each pound of dough and flour used, or a special dough may be made as follows. Into 10 lb. of flour rub 12 oz. of lard or butter. Make dough with 1 qt. milk, 1 qt. water, 12 oz. sugar, 2 oz. salt, and 3 oz. yeast. This dough should stand altogether two hours, and should then be well kneaded. As soon as the spring leaves it after kneading, it should be pinned out to about ⅓ in. thick, then docked at regular intervals with a small docker about 1¼ in. in diameter, then cut with a plain cutter about 2½ in. diameter, each biscuit having the docker mark as nearly as possible in its centre. They should be neatly placed on clean baking sheets, washed over with milk, and allowed to prove in a dry heat for about twenty to twenty-five minutes, then baked in a warm oven. These biscuits or cakes should be stabbed once in the centre with a skewer just before placing in the oven.

Nursery Biscuits.

There is not now the same demand for *dinner rolls* as at one time existed, their place being taken for the most part by Vienna rolls; but where it is not possible owing to the lack of suitable appliances to make



IRISH BAPS



ENGLISH TEACAKES

SCOTCH BAPS AND MORNING ROLLS

TYPES OF BRITISH SMALL BREAD

the latter, it is better to keep to the old-fashioned dinner roll than to make unsatisfactory imitations of Vienna rolls. For dinner rolls weigh 8 lb. flour, and rub into it 8 oz. lard. Make dough with 3½ pt. water at 100° F., or, if a good price can be obtained, use half milk and half water, 3 oz. yeast, 1½ oz. salt, and 1 oz. sugar. Make the dough very smooth by thorough mixing. Knead at the end of an hour, then allow it to lie for another hour, when it should be ready for scaling. These are made in several more or less plain shapes: in some cases merely rolled round like buns, sometimes oval, and sometimes round with a deep cut across the top. These forms all have crusts inclined to be tough. Much the best plan is to bake the rolls, weighing about 1½ oz. each, in old-fashioned dinner-roll pans, like dariole moulds, about 2½ in. high, and narrower at the bottom than at the top. The rolls should be proved till they just reach the top of the pan, and then baked. The usual practice is to rasp the tops of the rolls. The crust is crisp and sweet, and the crumb is fine and seems almost to dissolve in the mouth.

Old-style Dinner Rolls.

The *Scotch breakfast roll* or *bap* (Plate, TYPES OF BRITISH SMALL BREAD) is a good selling article even out of Scotland. These rolls are generally made by the sponge-and-dough system, the sponge standing about twelve hours to suit the requirements of Scottish labour conditions. With compressed yeast such a sponge would consist of 30 lb. flour, 3 oz. yeast, 4 oz. salt, 2 oz. sugar, and 2 gal. water at 86° F. These would be well stirred in a tub and scraped down at the sides, and thickly dusted over with flour on top. In the morning this will have risen in the tub and dropped 3 or 4 in. Dough is made with 30 lb. flour, 8 oz. lard, 6 oz. salt, 6 oz. sugar, and 5 qt. water at 100° F. The dough is well toughened by mixing, and then allowed to lie about half an hour to recover, when it should be ready for scaling. If the rolls are to be of the smooth-topped sort (Plate, TYPES OF BRITISH SMALL BREAD) they are first moulded oval, then gently pinned out till they are about 3 in. long and 2 in. wide. They are then placed close together in rows on the table and well watered on top, after which they are transferred to heated boards thickly dusted with cones. They are allowed to prove for about thirty minutes, and are then transferred to the oven, each roll being lifted from its board to a thin long peel used for the purpose by means of a flat tin lifter. They must be baked in a very hot oven; otherwise they have a tough skin and take no colour. Rolls and baps are sometimes made white, and either oval or three-cornered (Plate, TYPES OF BRITISH SMALL BREAD). In the latter case they are moulded in pieces weighing 9 oz., pinned out to about 8 in. in diameter, and then cut into three. This sort is not washed over with water, but simply placed on the heated boards when cut and then dusted over with flour, and again dusted just before being placed in the oven. This dusting causes the baps to be quite white but yet not sickly-looking when baked. To prevent blisters, the finger is pressed into the centre of each bap before setting in the oven.

Scotch Breakfast Roll or Bap.

Irish baps (Plate, TYPES OF BRITISH SMALL BREAD) are made from

dough somewhat similar to the above, but are handled differently on the board. They are made round in the smaller sizes, but the larger sorts, weighing from 8 oz. to 1 lb., are made of diamond shape. This form is obtained by first moulding the bap in a sort of torpedo shape, thick in the middle and pointed at the ends. By pressing the two ends towards the centre with the thumb and fingers of each hand the thickness of the centre is exaggerated; then it is pinned out until it is about ½ in. thick and more or less diamond-shaped. It is then turned over and proved on its top on a board thickly dusted with flour. The baps are proved rather close together, but are prevented from sticking by being well dusted over. When sufficiently proved they are turned over on to the left hand by a deft movement of the right hand, which catches the bap on the side with the side of the thumb; and when it is slightly lifted up by this means the hand is smartly turned underneath it, and it is turned over on to the left hand and transferred to the peel.

Irish Baps.

When baked these baps are about 2 in. thick, and are light and pleasant to eat. Baps or rolls of the Scotch type can be equally well made on a short straight-dough system. Weigh 10 lb. flour and rub into it 6 oz. lard. Make dough with 2½ qt. half milk and half water, 3 oz. sugar, 2 oz. salt, and 5 oz. yeast. This dough will be moderately soft, and should be toughened by mixing. After lying one hour it is well kneaded, and then allowed to rest about half an hour more. It is then scaled to the sizes wanted and moulded. If it is impossible or inconvenient to bake these rolls on the oven bottom they may be proved and baked on baking sheets, cleaned, and then dusted with cones. Made on the short process just given, they will require to prove—not in steam, however—for about an hour and a quarter. They should be baked till the skin just feels hard, but it will become very soft as soon as they cool slightly. Very small sizes, not much larger than an egg, may be made for use as plain sandwiches, and, as they are very soft, they taste very nice made up in this way. The sort dusted on top are more suitable for the purpose just mentioned than those that are washed over, as the skins of the latter incline to be tough.

Short Process for Baps.

Sandwich Baps.

On the border line between bread and buns there is a fermented scone called a *teacake*. This is more common in Yorkshire than elsewhere in England, but similar things are made nearly everywhere. For Yorkshire teacake (See plate, BRITISH SMALL BREAD) weigh 5 lb. moderately strong flour, and rub into it 8 oz. lard. Make a ferment with 1½ pt. milk and 1 pt. water, both together at 100° F., 3 oz. sugar, 8 oz. flour, and 4 oz. yeast. Whisk these ingredients together, and let the ferment stand in a warm place until it drops. This will take about three-quarters of an hour. There is enough liquor here to make dough, but 1 oz. salt and 4 oz. sugar are added at this stage, as well as 1 lb. of thoroughly cleaned currants. The dough is allowed to stand covered up in a warm place for one hour, when it is ready for scaling. The pieces are weighed about 4 oz. each and pinned out about 5 in. in diameter,

Yorkshire Teacakes.

and proved on slightly greased baking sheets. They are washed over with milk, or with a mixture of milk and egg, when first placed on the baking sheet; then just before baking they are stabbed with a skewer to prevent blisters. They should be baked in a rather warm oven. The Scotch method of preparing teacakes differs from the above only in the method of baking. The mixture may be the same, and the dough is made with a ferment as above, but after the teacakes are pinned out and placed on the tin they are washed over with an egg glaze consisting of about half egg and half milk. When properly proved they are placed in the oven, but as soon as they are set sufficiently to handle without spoiling they are turned over on their tops. It is not necessary to stab these, but one must be careful to turn them at the right time. If they stand over long before turning their tops become too much set, resulting either in the top being very narrow when baked or in the formation of a large blister. If they are turned too soon, the result is that they are thin and close and probably tough. Teacakes made in this way look very showy and sell well. Very small ones, weighing about 1 oz. each, but prepared in the same way, also sell well.

Scotch Teacakes.

Bakers who serve hotels and high-class restaurants are frequently asked to supply *pulled bread*. This consists simply of new bread, the crumb of which has been pulled in pieces about 2 in. long, 1½ in. broad, and about ⅓ in. thick. These are placed on a baking-sheet, and nicely browned and dried in the oven until they are quite crisp.

Pulled Bread.

CHAPTER XXVII

BRITISH SPECIAL AND FANCY BREADS

The greatest diversity of opinion prevails amongst bakers as to what is fancy bread. The rough interpretation of the term as recognized by the Bread Laws is: Bread that cannot readily be mistaken for plain bread. The distinguishing mark in this case is some difference in shape or in glaze; but the baker in a technical sense gives the term fancy bread a much wider meaning, and makes it include all sorts which involve more labour in manufacture, or entail greater cost for materials. In this matter, however, there is a very marked difference in the method adopted in different districts in fixing the position of any new sort of loaf by bakers. In Scotland, and to some extent in Ireland, there is one sort of bread universally recognized as plain: all other sorts whatever are classed as fancy. In England there is no well-marked division between plain and fancy, the result being that the fancy bread of one day becomes the plain bread of the next: and as the law requires that all plain bread must be sold by weight, whilst fancy bread is exempt, it becomes much to the interest of the English baker to make as few varieties of the former as

Definitions of Fancy Bread.

possible, while in the case of the Scotch and Irish bakers each new creation in the way of a variety may be a source of fresh trade and profit, because its weight may be reduced below the usual by an amount sufficient to compensate for extra labour or materials, or in part payment of the ingenuity used in its production. On this account the variety of bread is generally greater in Scotland and Ireland than in England.

Effects of Loose Definition in England.

Bread does not lend itself to great variations either of shape or composition, nor is it a suitable medium for making up with other materials used as food. Compounded breads are more or less in the nature of fads, and never find much favour with the public, who are, after all, the arbiters in such matters. In making additions to bread there are several cardinal points which must be observed. The colour should not, by additions, be made brownish or gray, or in the least approach what is regarded as dirty; the taste of those added substances must not be so pronounced as to destroy and mask the taste of the bread proper; the added substances must be only such as have a mild flavour that will blend with the recognized nutty flavour of bread; nothing must be used which will destroy the texture and vesicularity of the bread. Conforming to these conditions, we have milk, butter, lard, oil, malt flour, malt extract. Of these, milk is the most popular, and, all things considered, probably the most valuable. As the value of milk in bread is due to the butter it contains, it follows that improvements due to milk and to added butter have much in common, only that when butter is used it must be mild in flavour, and the quantity must not be sufficient to make its taste decided in the bread. The effects of milk and butter are to improve the flavour, texture, colour, and physical properties of the crumb. Lard and tasteless oils affect only texture and shortness, whilst malt and preparations containing malt are only used to impart flavour to special breads.

Compounded Breads.

Allowable Additions to Bread.

Effects of Added Milk or Butter.

There is no rule or method followed in naming special and fancy breads, and in consequence the names are arbitrary and confusing, as the same sort of loaf may be known by entirely different names in localities only a few miles apart. The names adopted for the following recipes are intended only as distinguishing marks, and not as signifying types of bread. In this respect it may be suggested that bakers do not make the best use of their opportunities in giving distinctive names to their special loaves, but content themselves with such common names as *milk loaf*, *currant loaf*, &c., names in fact that are really the creation of the customers to express what they require rather than of the baker.

Confusion of Bread Names.

The following recipe is for a loaf made in shape exactly like an ordinary household, but baked on a tin. Its special character depends wholly on its quality. It is variously called a *Windsor* or a *Castle loaf*. It may be made on either the sponge or the straight-dough system as follows. Set a thin sponge with 10 lb. flour, 1 gallon of water at 100° F., or such temperature as will make sponge when finished about 82° F., 7 oz.

Windsor or Castle Loaf.

yeast, and 2 oz. sugar. This sponge is best made in a small tub or wooden pail, and should not be stirred with the hand but beaten well with a stick or broad spatula. It should then be scraped from the side of the tub, the top thickly covered with flour, and the tub then covered with a sack and set in a warm place where it will not be disturbed. In about 45 minutes this sponge will have risen several inches and dropped. While it is fermenting weigh 40 lb. flour of high-class home millers' patent, or half home-milled and half Hungarian, and rub into this 1½ lb. lard, taking care to rub the latter till it is as fine as meal. Make a bay with the flour thus prepared, and weigh into it 4 oz. sugar and 9 oz. salt. Dissolve these in the water, of which 1¾ gallon at 100° F. will be required. Keep back half a gallon of this water to rinse out the sponge tub. Empty the sponge into the water in the bay and mix thoroughly, afterwards rinsing the tub as directed, using the rinsings as well to make dough. Toughen the dough by mixing and kneading until it is quite smooth. Pin it up close in the trough, and cover to keep warm. After it has lain about an hour and a half it should be well pinched and kneaded, and then in half an hour more it should be ready for scaling. If these loaves are to be sold at the same price as the ordinary 2-lb. loaf, they should be weighed about 1 lb. 10 oz., and not more in any case than 1¾ lb. Loaves are handed up into boxes and allowed proof about half an hour. They are then moulded, each loaf in two halves, and one placed neatly on the top of the other, both closings downwards. After lying a minute or two to recover they are well pressed, bashed neatly in centre with the elbow, and placed evenly in an iron box close together, each row being greased with melted lard or tasteless oil. The box should be about 20 in. wide and 3½ ft. long, and with sides all round about 5 in. deep. It should be greased, not so much to prevent the loaves from sticking, as to give them a short crisp crust when baked. The box should be slightly warmed before the loaves are placed in it. This size will hold thirty loaves, each being as nearly as possible 5 in. square. When all are in position their tops should be docked with a docker having teeth rather wide apart, and then washed over with milk. About twenty minutes' proof is allowed, and the loaves are then baked in an oven about 420° F. for one hour. When done they should be rubbed over on the top with lard while hot, and then turned out of boxes on their tops. When separated these loaves have an extremely nice appearance, the crumb being white, with even texture and silky pile. They should not be more than about 4 in. high. They therefore cut an oblong slice with fine texture, and the bread eats short with good flavour.

Relative Prices of Fancy and Plain Bread.

Iron Box for Batch Bread.

If it is more convenient to work with a straight dough, the following quantities may be used. With 50 lb. flour, half Hungarian and half first patent from English mill, or wholly the latter, use 8 oz. compressed yeast, 5 oz. sugar, 9 oz. salt. As before, rub 1½ lb. lard into flour, and make dough with 2¾ gallons water about 100° F. Mix the dough very thoroughly, and pinch and knead it until it becomes

Straight Dough for Windsors.

elastic and smooth. This dough will stand about three hours in trough, and should be kneaded well twice within that time. It is then scaled, handed up, and moulded in the same way as other dough. The straight-dough method does not produce quite such a clear-looking loaf as that made with sponge, and, when stale, it seems to be drier and shorter. In either case, however, if the loaves are allowed to prove too much in the boxes, they run into each other, and do not break with nice, smooth, bright sides.

In parts of Ireland bread is baked in tins in this way, the dough, however, being only ordinary sort. In Limerick this kind of loaf is called a *cottage*, being moulded exactly like an English cottage, the top being about half the weight of the bottom. These two parts are first moulded round in the ordinary way; then after proving a little separately they are rolled out long and topped, and placed in an iron box quite close together, but all in one row. For this sort of loaf the box is about 4½ ft. long and about 8 in. wide, with deep sides. When the tin is filled it is placed in a warm place, and the loaves are allowed to prove for 25 to 30 minutes, then baked in the usual way. These loaves look like flat plates of bread about 7 in. broad, 5 in. high, and not more than 1½ in. thick. In this case, as in the other, if they are given too much proof, they run into each other and do not break off flat and smooth. They are washed over on top before being set in the oven and with grease when they are drawn.

Limerick Cottage Bread.

In Scotland a type of fancy loaf much more common thirty years ago than now is called a *Jenny Lind*, or shortly, a *Lind* (see Plate, TYPES OF SCOTCH AND FANCY BREAD, No. 4). The source of the name was obviously that of the great singer, but the reason for naming this particular kind of loaf after her is not so obvious. This loaf is round and flat, and consists of top and bottom about the same size rolled out with a rolling-pin, proved in hot air on baking sheets, and heavily glazed with egg before baking. The dough for these loaves is made much tighter than ordinary dough. The usual practice is to take part of the small bread sponge and mix in about 1 oz. of lard and ½ oz. of sugar for each loaf, then to stiffen up this sponge with flour to the required stiffness. This dough is, after lying a little, well braked or passed through biscuit rollers until it acquires a perfectly smooth skin. It is allowed to lie for about two hours, and then scaled off in pieces, about 1 lb. 12 oz., to sell at the same price as the ordinary 2-lb. loaf. When all are moulded the halves of each loaf are pinned out to about 6 in. diameter and 1 in. thick, and placed one on top of the other, then pressed close with the heel of the hand and placed on baking sheets, slightly greased; the loaves are set some distance from each other to allow for spreading; about eight loaves on each sheet is the rule. They are docked and washed over with milk when placed on sheets, and put away to prove in a dry heat, but protected from draughts. If they are placed in a prover with a moist atmosphere they need not be washed over in the first instance at all, but it is dangerous to use naked steam to prove these loaves, as it not only causes them to spread

Jenny Lind Loaf.

TYPES OF SCOTCH AND FANCY BREAD

1. French Staff or Long Vienna.
2. Belgian Roll.
3. Baton.
4. Jenny Lind.
5. Scotch Pan.
6. Coburg.
7. Fancy Milk.
8. Fancy Rumpy.

TYPES OF SCOTCH AND FANCY BREAD

too much, but spoils their appearance by producing blisters all over the crust. Owing to the dough being stiff they may take an hour to prove, whilst in some cases 45 minutes may be sufficient. They are carefully washed over with a strong egg glaze, but before being placed in the oven they are stabbed in about six or eight places with an iron skewer, as a precaution against large holes forming under the top crust or in the centre of the top part. These loaves, even after being given a good proof, are very close in texture, yet not by any means heavy. The crumb is short and pleasantly sweet. Customers do not keep to this kind of bread constantly, but seem to tire of it readily.

Prevention of Blisters and Holes.

Instead of stiffening up an ordinary sponge or piece of dough to make this class of bread, a short sponge may be made thus. Take 5 lb. flour with 2 qt. water at 104° F. Mix 5 oz. of yeast into about 1 pt. of the water, and add 2 oz. of sugar. Make the whole into a thin sponge in a large jar. Allow it to stand one hour. Make dough with 15 lb. flour into which 6 oz. of lard has been finely rubbed, and 3 pt. water in which 3½ oz. salt and 1 oz. sugar are dissolved. It is better to keep one pint of this water to rinse out the jar in which the ferment or sponge has been made, and as this is a cooling operation the water at first should be about 104° F. The dough will be stiff, and on that account should, after lying half an hour, be passed several times through a biscuit brake, or, if this is not available, it should be well elbowed until quite smooth. Elbow or brake it again in another hour; then, after allowing it to lie about 15 minutes to recover, it may be scaled into the sized pieces already indicated, and moulded on to tins and treated as already described. Dough made in this way requires to be proved as loaves for from 45 minutes to one hour.

Linds from Sponge and Dough.

In Scotland it is usual to make several different shapes from the same dough. The most common is that locally known as a *French loaf*. This is made generally about the same weight as the Lind. The pieces are first moulded long, then, either through a biscuit brake or with a rolling-pin, they are made into long sheets of dough about 14 in. long, 5 in. wide, and about ¾ in. thick. The ends are folded into the centre, and the double ends thus formed are turned over one on the top of the other. These loaves are proved on tins, back to back, as by this arrangement the backs are prevented from crusting too quickly, and the fronts of the loaves spring first and open out in the manner desired. They require about as long to prove as the other, and, when ready, they are glazed over with egg wash and perforated several times through the back with a skewer to prevent the formation of holes or blisters. This method of making Scotch French loaves is confined principally to country districts. The practice in the large towns is to make them from ordinary dough, a little stiffer than usual, and sometimes with, but more often without, a pound or so of lard per sack of flour. When the dough is of this sort the West of Scotland practice is to prove the loaves in boxes, and then set them

Scotch French Loaf.

Different Methods of Baking in East and West Scotland.

with ends touching each other, but back to back, on the oven bottom, without any tins. The practice in the East is to bake these in long, shallow tins, with sides about 2 in. deep, the loaves, however, in this case as in the other being *batched* or close together at the ends. These loaves take about one hour to bake, and, when done, are washed over the upper edge with water only, which imparts a gloss to the surface, especially if the oven has been moderately warm. The standing difficulty in making this shape of loaf, whether from ordinary dough or from the stiff sort first described, is that of avoiding large spaces under the top crust, or, on the other hand, of preventing the two parts of the loaves from sticking together at the front, where they should open, and cracking at the back, where they should be continuous. One cause of the latter defect has been already noticed, viz., want of protection for the back and the formation of crust too soon. But another, and the most usual, cause is unripeness of dough. The persistency of holes is usually the result of bad moulding, but may also be due to the dough being over-ripe. This type of loaf is made in several parts of the country, although hardly in two districts under the same name. In some parts they are called *bricks*; but *turnover* is a more common name, whilst in Ireland large loaves of this shape are called *lumps*, and in some parts, notably in Limerick district, where they are made very thin, they are called *household*.

Holes in French Loaves.

Another shape of loaf made from the same kind of dough as Linds is one or other form of the *rumpy* or *porcupine loaf* (see Plate, SCOTCH AND FANCY BREAD, No. 8). There is no difference in the mode of manipulation, except that the loaves are first moulded or *chaffed* round, and then made oval, and proved on tins slightly greased. When sufficiently proved, they are glazed over with a wash consisting of one egg mixed with enough water to fill half the egg shell, or one yolk with twice that amount of water, the water and egg in each case being thoroughly well mixed, so that the texture or grain of the egg is quite destroyed; otherwise the loaves may be streaky. The wash must not be applied as soon as the loaves are moulded, as is sometimes done, for the loaves are then hardly half the bulk they are after proof, and the smaller surface covered at first will only show as a round glazed patch after proof, while the greater part of the loaf has a comparatively dull appearance. After washing over, the loaves are neatly cut with a sharp knife; a pocket knife serves best for this purpose. The usual design consists simply of straight parallel lines or of diagonal lines crossing each other, forming diamonds. The cuts must be very light, only cutting the skin; otherwise, if they are deep, they open out too much, and produce too broad a line of white as compared with the darker crust on each side. But clean cuts and not scratches must be made, or the crust of the loaf looks rough and ragged. As a rule, loaves allowed to prove thus freely are clearer and lighter than those confined in tins.

Rumpy Loaf.

Strong Egg Wash.

The shape called *Coburg* (Plate, SCOTCH AND FANCY BREAD, No. 6) may also be made from stiff dough. It is manipulated in exactly the

same way as rumpies. The loaves, after moulding oval, must in this case, however, be washed over and cut at once, as they have to be proved under the covers. Those covers are usually oval, similar to the brown bread covers; but oblong or round ones may be used for variety. The cutting is done in the same way as already described; but when covers are used, more ingenuity may be exercised in the designs with good effect. Besides parallel lines and diamonds, radiating lines, parallel angles, leaves, ferns, curves, &c., may all be made on the loaves by the use of egg wash and a sharp knife. As in the case of brown bread baked under covers, it is better to keep one of the covers mouth upward to note when the loaves are sufficiently proved; and as white dough springs a good deal more than brown, the loaves must not be proved above 1½ in. from the top of the tin before they are set in the oven, and 14 oz. of even stiff dough will be quite sufficient to fill a cover of 1 lb. size. This kind of bread, like all the others made from stiff dough, has a close and even texture, and breaks quite short. It eats sweet and moist, and keeps moist longer than bread made from much softer dough. It is, of course, sold at a higher price than plain—usually 14 oz. for 2*d.*, or 1½ lb. for 3*d.*

Scotch Coburg.

Cut Designs on Loaves.

Pan loaves of fancy shapes are generally recognized and sold as fancy bread. The ordinary round shape like a roller, called a *pistol*, may be made from ordinary dough; but like the *fluted loaf*, or what is known as a *toast loaf* (Plate, TOAST AND MILK BREAD), it is better made from a special dough, for which the following method will be found suitable. Weigh 40 lb. English patent flour and make into a slack dough with 2½ gal. water at 100° F., 3 oz. sugar, 8 oz. salt, 8 oz. lard, and 10 oz. yeast. Work this dough till it becomes very tough and elastic, the operation taking by hand quite 20 minutes; or if a small machine is available, mix it in the machine for 15 minutes. When thoroughly toughened, work in 6 lb. more flour until it is thoroughly mixed. Allow this dough to lie in a warm place for 2½ hours altogether, kneading thoroughly twice in that time. It should then be ready for scaling. As this dough is very elastic, 2 lb. of dough for each loaf will be as bulky when baked as 2 lb. 3 oz. of ordinary dough; and for close tins, whether round or oblong, the smaller quantity will usually be sufficient. The loaves must first be handed up, and then moulded after lying about 10 minutes. Moulding has to be done with some care, as the toughness of the dough makes it difficult to work for those familiar only with ordinary dough. When moulded, the loaves should be neatly placed in a row, and, when a sufficient number are done, well greased all over with melted lard, and then placed in the tins which have been cleaned but not greased. This plan of greasing the loaves over instead of the tins gives the loaves a nice rich bloom, and makes their crust very short and crisp. Loaves made from dough of this kind do not require to be proved so high in the tins before setting, but should be placed in the oven with a smaller proof than ordinary tin bread, as they spring a

Fancy Pan Loaves.

Greasing Bread.

great deal more while baking. The bread will be of an even texture with a fine pile, and will cut without crumbling; but bread made in this way seems to become dry when stale. This method is very suitable for plain pistols, for toast bread, or for Scotch pans baked four in one pan. Instead of using lard in the mixture, a better loaf is obtained for all the sorts mentioned by using half milk and half water for dough-making; but in this case it is necessary to bake the bread a little more; otherwise it seems underdone. This last sort of bread may properly be called milk bread, and sold as such, the price being, if possible, 50 per cent more than plain.

CHAPTER XXVIII

HARVEST FESTIVAL BREAD

Towards the end of September or the beginning of October each year, bakers, especially in the southern parts of England, are frequently asked to supply large loaves for harvest festivals in churches. Anything large seems acceptable, such as a monster cottage, or a twist, or a long loaf of inordinate length, but preference is usually given to the wheatsheaf (see Plate, HARVEST FESTIVAL LOAVES), as the emblem of plenty, and if this loaf is of good size and neatly made it approaches as near the ornamental as the bread baker can get. A convenient size for a loaf of this kind is about 26 or 28 lb. of dough. Ordinary bread dough made a little stiffer than for crusty cottage bread will suffice, but it is really better to make a special dough for the purpose. It is a mistake some bakers make to have the dough as stiff as that for biscuit, the result being that the loaf hardly springs at all, but is more like a hard tile than a plump, soft, healthy-looking loaf. Weigh 18 lb. patent grade flour similar to that used for bread, and make into a smooth dough with 6 oz. yeast, 4 oz. salt, 2 oz. sugar, and 3½ qt. water at 100° F. Allow this dough to lie 1 hour; then knead well, and after another 20 minutes beat out into a sheet of dough about 2 in. thick with the knuckles first, but finishing with a thick rolling-pin, or through a biscuit brake if that is available. This gives you a sheet all alike in thickness, with a smooth surface and an even texture. From this piece of dough cut out with a sharp knife a part the shape of a wheat sheaf (fig. 15); then cut the edges all round in a sloping direction, so that the dough next the baking sheet is

Harvest Festival Bread.

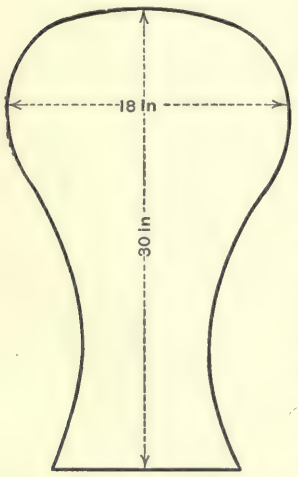


Fig. 15.—Shape of Sheet of Dough for Harvest Festival Loaf

Making a Wheatsheaf.

HARVEST FESTIVAL LOAF

WHEATSHEAF LOAF

HARVEST FESTIVAL LOAVES

quite thin, and sloping upwards, to give the sheaf a rounded appearance. This shaped piece should be, at the head and widest part, about 2 in. less than the width of the baking sheet on which it is placed. The cuttings from the rough sheet of dough will be sufficient material for the wheat ears and stalks. Before making these the sheaf should be well watered all over, to prevent it skinning, as well as to act as a means of holding on the ears. These are made singly (fig. 16). Each ear should not contain more than about $\frac{1}{3}$ oz. of dough. This is rolled out under the hand, and made pointed at one end and rounded at the other. The rounded end is pinched between the two forefingers, the ear lying or hanging along the palm of the hand with the point downwards. With a small pair of scissors thin cuts are made down the centre of the ear about $\frac{1}{4}$ in. deep, and in a direction nearly parallel to the ear itself, finishing at the pointed end. This has the effect of making a row of sharp-pointed pieces overlapping each other down the centre of the ear. In the same way cuts are made down each side of the ear, between the flaps of the centre row. When finished, the ear is rolled gently under the hand on the table. The result is a very good imitation of an ear of wheat. When a number of these are prepared (and they are easier to make than to describe) they are placed close together, but not touching, all round the top of the wheatsheaf. The next row is placed between these, but farther down, leaving about $1\frac{1}{2}$ in. of the first row exposed. To make the sheaf look natural, care must be taken after the two top rows are in position not to place the others too formally. To this end each succeeding row should not have the points too regular, either in distance apart or in position or direction (see Plate, HARVEST FESTIVAL LOAVES). The ears at the side should point in the same direction as that in the body at the head; only some of them should be turned slightly round as if drooping. Altogether about six rows of ears will be required; but, of course, as these approach the centre the rows become smaller. When enough are done and placed in position, wheat stalks have to be made. These are simply small pieces of dough no larger than those required for ears, but rolled out very long, and about the thickness of a wheat straw. The sheaf being kept quite moist by repeated washings with

Wheat Ears.

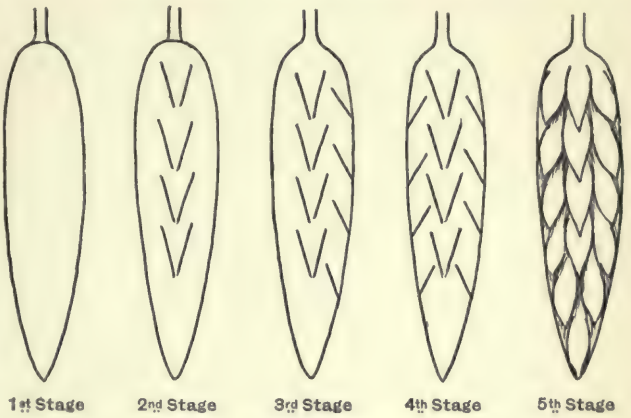


Fig. 16.—Stages in Preparation of Wheat Ears

Making Straws.

water, the straws when made are placed on it close together until the whole is covered; then a second row may be placed on top of these, especially in the centre, but not in formal order. The straws finish where the ears begin; and as it is not possible to make neat joinings or to hide them, a number of ears should be cut and placed at irregular angles, some drooping to one side and some to the other, with some bent round as if drooping towards you. The next thing is to prepare the band. This consists of about twelve straws placed together and twisted round loosely, then tied in a loose knot in the centre. This is then placed across the centre of the sheaf, bent slightly, but not pressed down at all, the two loose ends being tucked underneath at the sides. When all is finished, it is thoroughly glazed over with egg wash, care being taken to force the wash into the crevices between the ears and under the edges of the band. By the time all this is done the loaf will be ready for the oven; but before setting it there, it must be stabbed in a good many places with a pointed knife to prevent its cracking. The knife holes should be made in the same direction as the wheat straws and ears, so as to show no cross marks when the bread is baked. The oven should be about 420° F., and a loaf of this size ought to bake in from forty-five minutes to an hour. It must be very well baked, so that the crust keeps crisp even when stale. There is some danger of breaking this loaf when removing it from the tin, and the break always occurs just where the band is. It is to reduce this danger, as well as to make the sheaf look natural, that the band is not placed straight across, but is bent; for the same reason, also, thorough baking is advised.

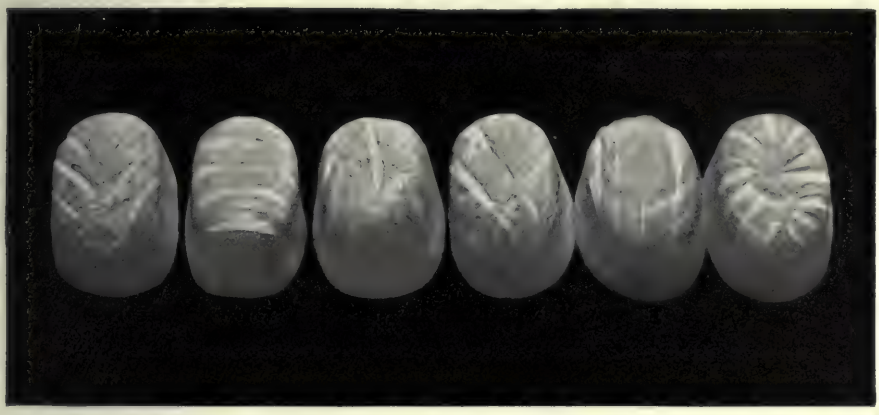
Sheaf Band.

Crowns, anchors, and other strange shapes are sometimes made by bakers for harvest festival displays; but these, made with dough, are neither beautiful in themselves, nor are they appropriate to the occasion. Besides the wheatsheaf, there is another form of harvest loaf which is appropriate, and that is a long plain loaf as flat as possible on the top, and with the words *harvest festival* printed on it. The recipe given above is very suitable for a loaf of this kind. The greatest ingenuity and skill can be displayed in the manner of writing the words on the loaf. Printing with icing sugar after the loaf is baked must be ruled out. The use of orange or lemon peel for the purpose is not so bad, as the contrast in colour between the brown of the bread and the darker brown of the peel is not so glaring as that between the bread and white sugar; but the proper material to use for the printing is bread itself. This is sometimes done by making little round pieces of very stiff dough, and forming the letters with these. The method is quite effective, but not very ingenious. Another, and an easier plan, is to wash over the loaf with egg wash just before it is placed in the oven, then to cut the surface with a sharp penknife in the form of letters which open out and show pale in a dark setting when the loaf is baked. If the cuts are carefully made of varying depth to represent hair and thick strokes, it is possible to make a large loaf look very neat in this way, particularly if

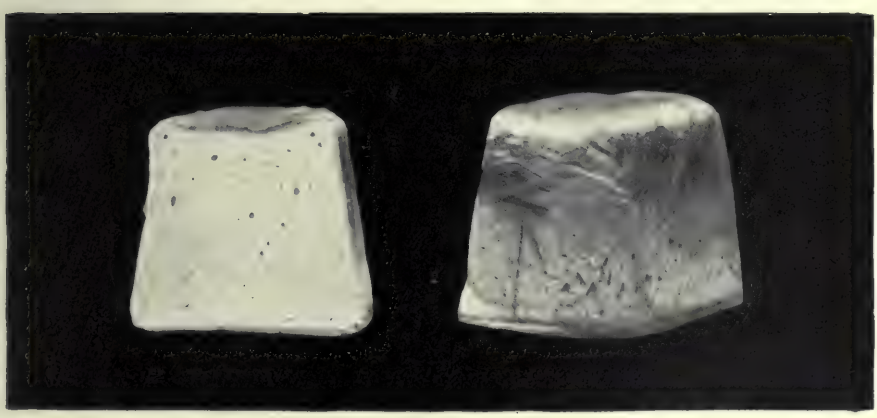
Long Harvest Loaf.

Printing on Bread.

BRUNSWICK LOAVES



MILK LOAVES SHOWING DESIGNS ON TOP



COBURG MILK LOAVES

MILK BREAD

a little ornament in the same style is made as a border. The most appropriate and the neatest way of forming letters and borders on harvest loaves is by the use of wheat ears. For the letters, these can be made of any size in proportion to the size of the loaf, and by making letters of fancy or rustic shape they may look very neat (see Plate, HARVEST FESTIVAL LOAVES). A harvest festival loaf of the size indicated above could not be sold under about 6*s.*, and this sum would hardly compensate for the time taken; only such loaves have at times to be made to oblige customers, and some return may be obtained by way of advertisement.

CHAPTER XXIX

MILK BREAD

All kinds of loaves are sold as milk bread, even some in which there is no milk used. A little glaze on the top or a little lard inside is sometimes made the excuse for the use of the name. In other cases, and these are probably most common, pieces of ordinary bun dough with the usual quantity of sugar and fat are baked in tins and sold as milk bread. The name is used now as signifying only bread made wholly or partly with milk in place of water. There is no technical difficulty about using milk wholly as the liquor with which to make dough; but the bread, from the baker's point of view, is not so satisfactory as bread made partly with milk and partly with water. When milk only is used, the bread is small and bound, probably because of the coagulation of the casein of the milk. If bulk is not specially desired, the proportion of milk to water may be as two to one; but excellent results are obtained if the proportions are half and half. Since the beneficent effects of milk are due to the fat it contains, the best effects are only obtained if new milk with all its cream is used. Skimmed milk is not, as might be supposed, suitable for use in bread-making, not so much because of the absence of its fat, but on account of the large quantity of milk sugar it contains in conjunction with lactic germs, which are always present in considerable number in milk, and which readily produce lactic acid from the milk sugar. This lactic acid, quite apart from its sourness, has an excessive solvent action on the gluten of flour, with the result that bread made with milk much more readily becomes dry and crumbly than that made with water. If it is made wholly with skimmed milk, these bad effects are likely to be twice as great as when half new milk is used, and the good effects accruing from the latter are absent from the former.

Milk Bread.

Faults in Bread made wholly with Milk.

Skim Milk Defects.

The general effects of the use of fresh milk are to give the crumb of the bread a rich creamy colour and an even texture, to make the crust thin and fine, and to improve the flavour of the bread. As a rule it is better

to make milk bread rather slack. The following method is recommended when the quantity is considerable. Make a thin sponge with 1¼ gal. water at 100° F., 15 lb. flour, 8 oz. yeast, 3 oz. sugar. This sponge should be made very tough by beating well in the tub with the hand or a stick. It should then be scraped clean on the sides, the top covered with flour, and a clean bag placed over the tub to keep out dust. If allowed to stand in a warm place it should rise and drop in about 45 minutes. For dough, weigh 33 lb. moderately strong flour, and of good colour, 9 oz. salt, 4 oz. lard or butter, 2 oz. sugar, 1 gal. milk, and ½ gal. water, the two last mixed together and heated to 100° F. Sponge is first broken as smoothly as possible with the milk and water and a smooth fine dough made. If a machine is used, the sponge need not first be broken up in the liquor but may be emptied in the machine on top of the flour, some of the liquor used to rinse out the tub, and the whole made into dough in the usual way. The dough should then lie in the trough for 1½ hour in all, and ought to be kneaded at least once and if possible twice. It should in that time be ready for scaling. It is usual to make it in small loaves weighing from 12 to 14 oz., which are sold at 2*d.*, or in 1½ lb. sizes or 1 lb. 6 oz. to sell at 3*d.* (See Plate, MILK BREAD.)

Recipe for Milk Bread.

The shape may be anything convenient, but these loaves are usually made in tins. A small cake hoop, either round or oval, may be used, and when the loaves are nearly ready for the oven they are cut on top rather deep with a sharp knife. Before cutting they should be washed over with a weak egg wash, not so much to make them glossy as to give them a rich bloom. A common shape is that already described as a Coburg (see Plate, MILK BREAD). When this shape is made with soft dough it must not be allowed to prove quite so much as when the dough is stiff; otherwise the cover will be lifted up and the loaf thrown on one side, giving it an unsightly appearance. Milk loaves may be made in long tins, a few cuts being made on top either lengthways or diagonally. A neat and rather fancy-looking loaf is obtained by rolling or moulding the dough into one long strip about 16 in. long, flattening it slightly, and rolling up from both ends into the form of an S-like scroll. This is proved in a fluted tin with slightly sloping sides. The bottom part of the loaf looks quite as if moulded in one piece, showing only the fluted marks of the tin, while the top shows the scroll form produced at moulding. This loaf is well proved and glazed with egg wash before baking (see Plate, TOAST AND MILK BREAD). If the milk bread is wanted crusty the loaf can be made round and proved on cloths upside down, then a crease made in the top as in the split Coburg (see the Plate, SCOTCH AND IRISH LOAVES).

Shapes of Milk Bread.

Instead of making sponge as above, excellent milk bread is produced by the straight-dough method as follows. Weigh 20 lb. flour, 5 oz. yeast, 3½ oz. salt, 2 oz. sugar. Make dough in the usual way, toughening it well by mixing with 2 qt. water and 2½ qt. milk mixed together and heated to 104° F. Allow this dough to lie 2½ hours, kneading well twice in that time; then scale, hand up, and mould in the usual way

Rich Milk Bread.

FLUTED TOAST BREAD

FANCY MILK LOAVES

TOAST BREAD

TOAST AND MILK BREAD

into any form desired. A milk loaf of very superior quality may be made thus. Rub into 10 lb. flour 3 oz. of butter; then make dough with 1½ qt. milk and 1 qt. water together raised to 104° F., 2 oz. salt, 3 oz. yeast, and 2 oz. sugar. This dough will be soft, and must be well toughened in mixing to make it easy to handle. It should be ready for scaling in about two hours after it has been made, but should be kneaded once or twice in that period. The pieces for loaves should be weighed at 1¼ lb. to be sold for 3*d*. They are moulded round, and, after lying a little, are flattened with a rolling-pin to about 6 in. diameter; then baked under covers consisting of ordinary round cake tins of the diameter mentioned, and about 2 in. deep. (See Brunswick Loaves, Plate MILK BREAD.) These tins or covers must have holes pierced in the bottom to prevent the tin rising as the loaf proves. These loaves may be washed over with a weak egg wash before the covers are placed over them, and one cover should be allowed to stand open end upward to show how proof is proceeding. The loaves must be made quite flat, and are ready for the oven when about ½ inch from the top of the open tin. When baked they should be exactly the shape of the interior of the tin, the same thickness throughout, with a fine and perfectly even texture, the crumb of a creamy-white, and the crust golden-brown.

Instead of using fresh milk for fancy bread, quite as good results may be obtained from the best quality of *dried milk*, of which there are now several brands on the market. This milk is guaranteed pure, that is, containing all the constituents of fresh milk except the water. This is much better than the so-called *condensed milk*, which contains a greater or less quantity of sugar. It is better than fresh milk, as the quality is always the same, and also because there need be no waste in its use, and it can be stocked, if kept in a cool place, for any reasonable time. It can be used in the proportion of 3 oz. of dried milk to each quart of water, or, if the milk is wanted extra strong, 4 oz. to the quart. There is no trouble in preparing the milk. It is made first into a smooth paste with warm but not boiling water; then the remainder of the water is added, and the whole well stirred. It seems very soluble. It is best to be made just as required. If dried milk is used for the above recipes, the milk can be added in the powder form to the water in the proportion required for the amount of milk to be used. This dried milk is equally suitable for all sorts of small goods in which milk is used; it should be noted, however, that cheap dried milks, of which there are also several brands on the market, do not contain the cream or butter fat, and therefore do not give the same results as the best, nor the same as fresh milk. These dried skim milks may be used with advantage in scones, cheap cake, &c., and may be used in smaller proportion in bread, the effect being to improve the texture, and give the crust a finer appearance.

Dried Milk.

CHAPTER XXX

CURRANT AND SULTANA BREAD

There is considerable sale for a plain loaf containing a few currants or other fruit, and for the last year or so this bread has been in even greater favour owing to extensive advertising undertaken by the government of Greece to boom the currant trade. If currants only are to be used the general practice is to work about 1 lb. of currants into 16 lb. of bread dough along with about 4 oz. of sugar. When a quantity has to be made it is really better to make a lighter dough, such as for tin bread, and mix currants along with it. Weigh 50 lb. flour and make it into dough with $2\frac{3}{4}$ gal. water at 100° F., 10 oz. yeast, 8 oz. salt, 10 oz. sugar, 8 oz. lard or other fat, and 6 lb. currants. The dough should lie in the trough for 2 hours, to be well kneaded once in that time. It should then be ready for scaling. The loaves are weighed at the rate of about 2 lb. of dough for 5*d*. The best shape of tin for this sort of bread is long and narrow, say 8 in. long, 2 in. wide at the bottom, $2\frac{1}{2}$ in. at the top, and 3 in. deep. This tin will enable a loaf weighing 16 or 18 oz. to look quite substantial and large. The top of the loaf, after proof, which may take half an hour after moulding, should be washed over with a weak egg glaze before baking.

Currant Bread.

Instead of using currants only in this dough an excellently flavoured loaf is obtained by using the same proportion of fruit, but consisting of half currants and half sultanas with, in addition, 8 oz. of orange peel cut very fine and 1 oz. caraway seeds. No change need be made in the method of handling if a slightly larger quantity of fruit is used, but the dough will require longer proof in tins. If the quantity of fruit is increased the weight of the loaves is decreased or the price raised to meet the extra cost; it is usually more convenient to reduce the weight, because of the need for keeping this sort of bread always at one price.

Mixed Fruit Loaf.

There is, in some districts, a demand for a richer fruit loaf than that described above. This sort of loaf is best made with a sponge or ferment, which may be prepared thus. Measure out $2\frac{1}{2}$ qt. milk and $2\frac{1}{2}$ qt. water; mix and raise to 104° F. Mix 7 oz. of yeast thoroughly in a small quantity of this liquor, then whisk the whole well together, add 1 lb. of sugar, and then thoroughly beat in 10 lb. of flour. This will ferment very vigorously, and if kept in a warm place should rise and drop 2 in. or more in 45 minutes. Weigh on the board or into the trough 16 lb. moderately strong flour, and rub well in 3 lb. lard or other tasteless fat. Make a bay and place round it 3 lb. sultana raisins, 3 lb. currants, and 1 lb. orange peel cut into small pieces about the size of currants. When the ferment has dropped, dough is made, no more liquor being required, but 3 oz. salt and 3 lb. sugar are dissolved in the ferment. After lying 1 hour, at the end of which the dough is well kneaded, it

Rich Fruit Loaf.

should be ready for scaling. About 12 oz. of this dough for 2*d.*, and 1¼ lb. for 3*d.* are the sizes most saleable. As this dough is somewhat richer than the others given, it is more sluggish in proof, but if kept at a moderate heat in the tins, should be ready for the oven in about forty-five minutes. Owing to the greater quantity of sugar in this dough, and the larger proportion of fruit, the loaves keep moist for several days.

Special Fruit Loaf.

It is often useful to make a speciality of a fruit loaf, and this should be done by making it of superior quality and different in shape from the ordinary; but when the quality and shape are determined, no effort should be spared to keep it always alike. A very superior loaf may be made thus. Make a sponge in a jar with, say, 1 qt. water at 104° F., 4 oz. yeast, 2 oz. sugar, and 2 lb. flour. This sponge will rise and drop in a little over half an hour. Make dough then with 3 pt. milk and 1 pt. water mixed and heated to 100° F., 11 lb. patent grade flour, 8 oz. butter, 2 oz. sugar, 1½ oz. salt, and 3 lb. sultana raisins carefully picked and cleaned. This dough will be softer than for ordinary bread, but stiffer than bun dough. It should be allowed to stand in a warm place for about one and a half hour, and then weighed into the sizes desired. To make a distinction between this and other fruit loaves, it may be made in the form of a twist and proved on a baking sheet. It will take twenty-five to thirty minutes to prove, but must not be made too light. After baking, it may be dusted over with icing sugar instead of being glazed.

Eggs in Bread.

It may be noted that none of the recipes given above, except one, contains a large quantity of sugar, nor any eggs. Fruit loaves that are sweet are more in the nature of buns, and do not hold customers so steadily as those that are soft and nicely coloured without sweetness, except that naturally belonging to the dried fruit they contain. Eggs in bread do not enhance its value in anything like proportion to their cost, and the loaves containing them really seem to eat drier when stale than if made without. Eggs have, of course, a special value in producing a rich colour, and in increasing the dietetic value of the bread. The small quantity of salt added removes the unpleasant freshness which is so apparent even when much sugar is used without salt.

Salt in Sweet Loaves.

The recipe given which contains the largest quantity of sugar should really be classed as one for a bun loaf. This article is in great favour in many parts of Ireland and in Scotland, particularly at Christmas and New Year season. In the north of Ireland this is made either in the form of a fruit loaf in 2-lb. and 4-lb. sizes, the latter selling as high as 3*s.* 6*d.* to 4*s.*, or in flat shapes baked on baking sheets, and called *barm brak* or *brack*. The price is determined by the quantity of fruit in it. The usual method, and not the worst, is to make a strong dough, or take a portion of bread dough and work in the other ingredients afterwards. For this purpose make a dough with 20 lb. moderately strong flour, 4 oz. salt, 2 oz. sugar, 6 oz. yeast, and 1 gal. water at 100° F. Allow

Barm Brak.

this dough to lie 2 hours; then thoroughly work in 2 lb. butter, 2 lb. sugar, and 8 eggs; and when this is all thoroughly mixed, work in 2½ lb. sultanas, 2 lb. currants, and 1 lb. orange peel cut fine. This tearing and mixing will have made the dough close and tough, so it should lie an hour to recover before scaling. If wanted for barm brak, the pieces are from 1 to 1½ lb. They are moulded round, then pinned out to about 7 in. in diameter and 1 in. thick, placed on greased baking sheets, and glazed over with strong egg wash; then placed in a warm but dry prover. Owing to the large quantity of fruit they contain, they will take quite an hour to prove, and will not then be bulky, as they are not intended to be extremely light. Before setting, they are again washed over with glaze and stabbed with a thin skewer to prevent blisters. They must be thoroughly baked, and in an oven not above 420° F. The fruit loaves made in tins receive the same treatment, and are also glazed on top, but not stabbed with a skewer. However, they need long proof, careful watching in baking, and must be very thoroughly done.

Irish Fruit Loaves.

In Scotland the old-fashioned bun loaf is made in a different way. The centre is the loaf proper, but is covered round with a paste made of fermented dough and contains butter as shortening. For the interior a straight dough made as follows is suitable. 20 lb. flour has 2 oz. mixed spice sifted through it and 2 lb. lard well rubbed in. A bay is made, and 2 lb. sultanas, 2 lb. raisins, and 1 lb. cut orange peel placed round it; 2½ lb. sugar is weighed into the bay, and 3 oz. salt. Dough is made with 2 qt. milk and 2½ qt. water mixed together and heated to 100° F. 5 oz. yeast is dissolved in a small quantity of the liquor, and the whole is then made into dough. This may lie for about three hours and be kneaded once in that time, after which it may be scaled into pieces of the sizes desired. The outer crust may consist of 5 lb. bread dough, into which 10 oz. of butter has been worked till quite smooth. For each 2-lb. centre about 6 oz. of this covering dough will be sufficient. The piece is pinned out till about ⅛ in. thick and more or less square. It is then well washed over with water and the fruit centre placed on it. Corners are cut out, and the four flaps thus formed turned up so as completely to cover the centre dough. This is pressed all over with the hands to ensure that the crust sticks to the centre dough and to prevent blisters. The whole loaf is then turned over, placed in a greased tin, and pressed well into the sides and corners, so that the centre at first is a little thinner than the sides. These loaves are generally made in flat oblong shapes. As the centre proves, the outer crust stretches with it, but the crust must be docked over on top, when first placed in tins, to prevent blisters. The loaves, kept in a warm place, will be ready for the oven in about forty-five minutes. They are then carefully stabbed with a skewer, and glazed over and baked.

Scotch Bun Loaves.

Covering for Bun Loaves.

This bun loaf seems to be only a lighter and cheaper form of the Scotch bun, which can hardly be described as a loaf, as it consists

wholly of fruit; but since it contains fermented dough this seems the most suitable place to give the recipe and method of making. This bun also consists of a centre mostly of fruit, with an outer crust of fermented dough shortened with butter. For the interior, take 7 lb. bread dough and mix thoroughly in it 14 oz. butter and 6 oz. mixed spice. When mixed spread out on the table, and weigh 10 lb. seedless or stoned raisins, 10 lb. cleaned and washed currants, 3 lb. orange peel, and 1½ lb. whole almonds (blanched). Place all these together on the top of the dough and tear the latter up amongst the fruit, gradually incorporating all together into a stiff dough, in which the dough and fruit are evenly mixed. This operation may require quite half an hour, turning the mixture backwards and forwards in small pieces, spreading and pressing to get the fruit to stick. When well mixed and holding together, it may be allowed to rest for an hour. It is then cut into pieces and blocked to size. This is done by dusting well the inside of the tin to be ultimately used for baking the bun, and pressing the piece of fruit mixture well into the sides and corners so that it exactly takes the shape of the tin; it can then be dumped out and will retain its shape. One tin of each size may be used to block all the buns of the respective sizes. The paste or crust for covering these is made by working 2 lb. of butter into 9 lb. of bread dough till it is quite smooth. For a bun weighing 3 lb., 6 oz. will be sufficient for cover; 8 oz. for 4 lb.; 12 oz. for 6 lb.; and so on. The cover is pinned out till it is a little more than twice the size of the bun it is to cover: it is washed over, the bun placed in the centre, corner pieces are cut out and placed on the bun where the cover will otherwise be thinnest; then the flaps are drawn over so as completely to cover the central part. It is then squeezed up thicker by pressing on the sides and ends; the tin in which it is to be baked, already well greased with cold lard, is placed over it, and tin and bun are together turned over. It is then squeezed out with the heel of the hand again to fill the tin properly, the centre of the bun being made a little thinner than at the sides. It is at once docked with a biscuit-docker to prevent blisters forming under the crust, and is also washed over with a little milk or water. After lying in this condition for an hour, the buns are stabbed all over with a skewer and washed on top with a weak egg glaze, and baked in an oven not above 400° F. One weighing 3 lb. will bake in 1½ to 2 hours; the larger sizes take a proportionately greater time. As the top crust becomes hard while baking long before the bun is sufficiently done, it is necessary, when trying whether it is properly baked, to turn it out of the tin and feel the centre of the bottom part with the finger. If done enough the bottom will be quite hard; if underdone, it will be soft and leathery, in which case it must be put back in the tin and allowed to stand some time longer in oven. When thoroughly baked the buns are turned out on their tops and allowed to lie in this condition until they are thoroughly cold before handling. This is a very old recipe for Scotch currant bun,

Scotch Currant Bun.

Blocking Buns.

Baking Times for Buns.

and has always given great satisfaction to customers. As the flavour is a special consideration, the spice mixture, which is also very old, may be given here, although it hardly belongs to bread-making; but it is suitable for all purposes in which spice is used. The quantities are:—Ground coriander, 8 oz.; ground cinnamon, 8 oz.; ground ginger, 4 oz.; ground nutmeg, 4 oz.; white pepper, 2 oz. These, of course, are intimately mixed together, and kept in a closed tin or wide-mouthed bottle for use as required.

Mixed Spice for Buns.

CHAPTER XXXI

HAND-MADE HARD BISCUITS

Biscuits are not bread, and yet can hardly be classed as confectionery; so there is a little difficulty in allocating the proper place in this work for instructions concerning them. Except in Scotland, there is not a very large biscuit trade now done by ordinary bakers, and even there the products of the biscuit factories have nearly destroyed a trade that twenty years ago formed a considerable portion of the work in nearly every Scottish bakery. There is still, however, a demand for hard biscuits of the water variety, and for ship biscuits, in the neighbourhood of fishing stations. In any case there is from time to time a return to old fashions, and on that account alone it is as well that bakers should retain the knowledge of how to make those articles which were in high favour with past generations of customers and the old-fashioned amongst the present generation; in some localities these are still well worth catering for.

Hand-made Biscuits.

Whatever kinds of hard biscuits are made, their quality depends on the character of the flour more than on anything else. Flours that are strong and particularly suitable for bread are unsuitable for biscuit work. For the latter very soft flours are needed, but not those which are soft only because they contain a high proportion of starch and a low proportion of soft gluten. Flours of this kind, of which some of the very soft American are good examples, produce biscuits that are thin and flinty and altogether unsatisfactory. Good biscuit flours are those which have very ductile glutens, and may have as much as 8 or 9 per cent without being too strong. French flours made wholly from French wheat are very suitable for biscuits; so also are flours from sound English wheats, and those from the good wheat areas of Scotland, although some of the poorer Scotch wheat has not sufficient strength even for this purpose. In hard biscuits there is not as a rule any aerating or raising agent, so that the extent to which the biscuits spring in the oven depends more on the expansion of the starch of the flour, but to some extent on the lifting tendency of the steam generated during baking. These springing effects in their turn are modified

Nature of Flour for Biscuits.

French, English, and Scotch Flour.

What makes Biscuits spring?

for good or evil according to the manner in which the dough has been manipulated before coming to the oven: if properly handled, the biscuits will be short and plump; if badly treated, they will be thin and hard, although in both cases the ingredients may have been entirely alike. When results of this sort are not caused by the mode of working, but, as already noticed, are due to the nature of the flour, the only thing to do is to add a small quantity of some aerating agent, either carbonate of ammonia or soda and cream of tartar. The quality of the biscuit also depends a good deal on the state of the oven, one that is hot producing much better results than one that is cold, with the reservation only that very thick biscuits cannot be baked in an oven suitably hot for thin ones, as they will acquire too much colour before they are baked in their centres.

Use of Aerating Agents in Biscuits.

At one time for ship's biscuits nothing was used but dressed seconds flour, but now flour of household class is more common. The following quantities and method will be found to produce satisfactory biscuits. Weigh 40 lb. flour on to the table, or, if a small machine is available, into the machine. To make biscuit dough of this will require $1\frac{1}{2}$–$1\frac{3}{4}$ gal. of water, in which 6 oz. of salt should be dissolved; no other ingredients are used. If dough is made in the machine, no special instructions are needed except that it should be made thoroughly. If it has to be made by hand, more care is needed to prevent scrap forming. The flour is formed into a bay on the table, and the salt placed in its centre. The whole of the water is then measured into the bay, and after the salt has been dissolved, the flour is drawn in until the whole is a mass of lumps of flour and water. This mixture is thrown back and forward with the hands until it appears to be all alike—no large lumps in one part and dry flour in another. This powdery mixture has then to be taken a little at a time, and rubbed very hard between the heel of the hand and the table, until it sticks together into little pieces of dough. This sort of manipulation must be repeated with the whole mass until it is really firm dough, the elbow being brought into use to stick it together at the last part of the operation. This dough should not be run through the biscuit rollers at once, but should be allowed to rest for half an hour or so. It is then well braked on the rollers, the sign of completion of this operation being perfect smoothness of surface and a close smooth surface internally when cut. It may happen that in braking the dough the surface cracks badly. When this is the case, it is best to wash the dough over with water and allow it to lie covered up for some time, after which it will be more pliable. The dough should lie another hour or so before being finally made into biscuits. If these are hand-made, some skill is needed in moulding or chaffing the individual biscuits—an intelligible description of that operation is hopeless—but if any considerable quantity is required, a small brake and cutting machine should be obtained. The biscuits are rolled out about a quarter of an inch thick. then cut and docked at one

Ship Biscuit.

How to make Biscuit Dough.

Rolling or Braking Dough.

When Dough cracks.

Biscuit-cutting Machine.

operation, if a machine is in use. If hand-made, each biscuit has first to be moulded round, then rolled out with a rolling-pin, and then docked. Biscuits made by hand are credited with being freer and "shorter" than those made on a machine. The sign of readiness when the biscuits are baking is an unyielding hardness on being pressed with the fingers, although correct observation in this respect really only comes with practice. These biscuits are much better when baked on the oven bottom than on tins, although in modern factories the latter method is always adopted. If ship biscuits are intended for long voyages, or to be kept a long time, baking only is not sufficient to prevent their becoming mouldy or maggoty: for such circumstances they have to be very thoroughly dried for a week or two in a hot room. It may interest those who are not familiar with the biscuit trade to know that from 1 cwt. of flour used not quite one hundred pounds of baked biscuits are obtained.

To know when Biscuits are Baked.

Drying to prevent Mould.

A biscuit called sometimes *cheese biscuit* and sometimes *water biscuit* is made much in the same manner as above, only a better quality of flour is used, and the biscuit is made very thin, and, as a rule, smaller. This sort of biscuit, if hand-made, is pinned out to about one-eighth of an inch thick, either singly or in sheets, and docked two at a time, and drawn asunder afterwards. They should be baked on tins, and must be thoroughly dried; otherwise they are very tough. In these, as in the ship biscuits, there are no ingredients used but flour, water, and salt. Another sort of cheese biscuit, which still finds favour, is made with a quantity of yeast in it. For a sack of flour 8 or 10 oz. of yeast is used, and after dough is made, it is allowed to lie about two hours before being braked. The mode of handling is similar to that already described, but these biscuits are made small and thick, and in consequence of the yeast are lighter than the other, usually in fact rather hollow in the centre.

Water or Cheese Biscuits.

Yeast in Biscuits.

Cabin biscuits are made with flour, water, and salt, but in addition they contain about 1 oz. of lard to each lb. of flour used. This biscuit is made about 3 in. in diameter, and belongs essentially to the hand-made sort. The dough should be stiff. It is either pinned out quite flat or slightly cupped, so that it can, if desired, be spread thick with butter and cream cheese.

Cabin Biscuits.

Cupped biscuits proper belong to a richer class, and for these the following may be used: flour (soft and white), 16 lb.; butter, or half butter and half lard, 1 lb.; sugar, 12 oz.; ammonia, about ¼ oz.; water, 2 qt. and 1 pt. This biscuit is made as already described, but cannot under any circumstances be cut out in a machine; each biscuit must be chaffed separately. The cupping operation is done by a dexterous use of an ordinary thin biscuit rolling-pin. The success of the operation depends on the dough being tough and more or less elastic, and this latter property is produced by the manner in which the biscuit is moulded. The operation of cupping cannot be described properly, but it consists in

Cupped Biscuits.

FORMER PRESIDENTS, NATIONAL ASSOCIATION OF MASTER BAKERS

THOMAS FLETCHER, born in Liverpool in 1850, started business in his native town, but subsequently removed to Birmingham, where he conducts a large and successful bakery. He took an active part in founding the National Association of Master Bakers, of which he was President in 1887 and 1902. He has been a member of Birmingham Town Council since 1904.

ALFRED TAYLOR, of the Old Red House, Bath, was born in Wiltshire in 1840, and served a good part of his apprenticeship in the bakery of which he is now proprietor. At one time he also had a farm and a cheese and butter factory. He was President of the National Association in 1893–94, and is a Director of the Trades, Markets, and Exhibitions, Limited. He is an Alderman of the City of Bath.

ROBERT KIRKLAND, born at Airdrie in 1853, gave up banking to join his brother in a baking and catering business in Liverpool. This business is now known as the Liverpool Vienna Bakery Company, Limited, and has Mr. Kirkland as Chairman. Mr. Kirkland is also Chairman of Fletcher's, Limited, Birmingham. He was appointed Baker to Queen Victoria, with authority to use the Royal Arms, and he is also baker to the Emperor of Austria and the King of Spain. He was President of the National Association in 1890–91.

HENRY MATTHEWS, born at Chudleigh, Devonshire, in 1821, learned the baking trade under his father. After a brief London experience he started in business in Plymouth in 1845, and is now head of Matthews & Sons, Limited, the largest baking business in the county. He was President of the National Association in 1891–92. He has been a member of Plymouth Town Council and a Poor Law Guardian.

THOMAS FLETCHER
(Birmingham)

ALFRED TAYLOR
(Bath)

ROBERT KIRKLAND
(Liverpool)

HENRY MATTHEWS
(Plymouth)

FORMER PRESIDENTS, NATIONAL ASSOCIATION OF MASTER BAKERS

not allowing the pressure of the pin to pass the centre of the biscuit at each stroke, so that while the edges become evenly thinned down, the centre remains thick, this thickness being removed at the last few strokes of the rolling-pin. The elasticity of the dough draws up the sides under such circumstances. The original purpose of cupping biscuits was evidently to admit of their holding a supply of jam or stewed fruit when about to be eaten. This recipe makes a good short-eating biscuit, the pinch of ammonia helping in some degree to make it light also.

Abernethy biscuits have a reputation associated to some extent with the name of the famous physician. They really belong to the shortbread class of goods, and among all the hand-made biscuits are likely longest to remain in public favour and to survive the rivalry of the machine-made article. The following is the recipe which has more than a local reputation: flour, 8 lb. (fine French); butter, 1¼ lb.; lard, 1¼ lb.; sugar, 1¼ lb.; water, 1 qt. and 2 gills. If the flour is suitable and care taken in handling the dough—for with so much butter, &c., it requires some care—this biscuit should spring well and be plump without any other raising agent; but if, on account of the flour or other cause, there is a tendency to flintiness, then ¼ oz. bicarbonate of soda and ½ oz. cream of tartar may be used with advantage. Owing to these biscuits being rich, the dough is liable to crack when braking or when moulding; on this account it must not be too stiff, nor should it be made with less than the proper quantity of water. This last precaution may seem superfluous, as the instruction not to make the dough stiff seems to imply that the proper quantity of water is used in its preparation; but this dough may really appear to be quite soft, even with a good deal less than the proper water, owing to the butter and lard melting with the heat of the hands. But dough made soft by this means is so short that it cannot be moulded at all, and presents when baked a rough and greasy appearance.

Abernethy Biscuits.

Aerating Agents in Biscuits.

Greasy Dough.

In Glasgow, where Abernethy biscuits are made by hand on a very large scale even in the bread factories, the mixture used is as follows: flour (soft), 16 lb.; sugar, 2 lb.; lard, 5 lb.; butter, 1 lb.; and 2½ qt. water. This mixture, it will be noticed, contains more fat than the other given above, and fat, too, that has a low melting-point. In consequence of this it is necessary to allow the dough to stand a long time before it is moulded into biscuits; otherwise these crack all round the edges. This dough is so greasy, especially in warm weather, that it can hardly be chaffed at all, but the pieces have to be rolled like buns, and then pinned out smartly. These biscuits have the quality of eating very short—in fact, not unlike ordinary shortbread.

Glasgow Abernethy Biscuits.

Effects of Excessive Fat in Dough.

Bath Oliver biscuits are a speciality still made in great quantities in Bath, and in which some of the leading houses take great pride. There is considerable diversity in the recipes used as well as in the mode of manufacture, but all agree in making the

Bath Oliver Biscuits, Fermented.

biscuit very thin and rich with butter only. Some use yeast in their manufacture, others do not. Rub 2 lb. of best butter into 8 lb. flour, and make into a stiff dough with about 2½ pt. milk in which 2 oz. yeast and 2 oz. sugar have been dissolved. If the butter is quite fresh, ¾ oz. of salt may be added. Allow this dough to ferment in a moderately warm place for about 1½ hour, then brake the dough till its skin is quite smooth. Allow it to rest for a little, then reduce the dough in pieces on the rollers till it is about ⅛ in. thick. Cut these out, generally two layers at once; dock with a plain docker and allow to stand for some time; then bake in a very warm oven.

Mode of Handling.

A biscuit equally good and less troublesome is made without any yeast whatever. For this the quantities are: flour, 8 lb.; butter, fresh and sweet, 2 lb.; salt, ½ oz. Dough is made with about 1 pt. water, 1¼ pt. milk, and 3 eggs. The dough is handled in exactly the same way as for the other hard biscuits, resting after being made, and again after braking. When they are cut out and docked the biscuits are baked in a hot oven.

Bath Olivers, Unfermented.

Seed biscuits are an old-fashioned sort made as follows. A dough much softer than for the other kinds of hard biscuits already described is made with 8 lb. soft flour into which 1 lb. of lard has been rubbed; 1 oz. yeast is mixed with nearly 3 pt. water, and ½ oz. salt is also dissolved in it. The whole is then made into dough, about 2 oz. caraway seeds being mixed at the same time. This dough is allowed to prove for about 2 hours, after which 2 oz. carbonate of ammonia is thoroughly mixed in it, and the dough then braked till smooth. It is allowed to lie to recover, and is then cut out and moulded or chaffed into biscuits in the ordinary way, then pinned out quite flat to about ⅛ in. thick, docked, and baked on baking sheets. On account of the absence of sugar these biscuits are quite white, but they are very light and open in texture. If butter is used instead of lard, and 1 lb. of sugar added to the mixture and the seeds kept out, the biscuits are then called *butter shorts*. The old method of working was to make dough for these biscuits with a small quantity of home-made barm. In the recipe given above ordinary dry yeast is substituted and the time the dough requires to lie very much shortened, but the article produced is much the same as that made by the old method.

Seed Biscuits.

Butter Shorts.

Bakers do not now make *cracknel biscuits*; yet they can still be made profitably, and their preparation may serve to fill in odd time. The following recipe and method will be found satisfactory. Make a smooth dough with 3½ lb. flour, 6 oz. castor sugar, 8 eggs, and about ¼ pt. water, in which is dissolved ¼ oz. carbonate of ammonia. Brake this dough till smooth, then allow to rest for an hour or so. Roll out then to about ⅕ in. thick, dock with a plain and wide-toothed docker, and cut with a 4-in. cutter, afterwards cutting each of those rounds into four three-cornered pieces; or the biscuits may be cut round or oval

Cracknels.

with a small cutter and afterwards docked with a docker of the same shape but of smaller size. When the biscuits are cut out, a large pan of boiling water should be ready, and as many of the biscuits dropped into it as will conveniently cover the surface. These will sink to the bottom when first put in, but will soon rise to the surface, and if allowed to boil a little will gradually acquire a cupped form. When this occurs they have been boiled sufficiently. The biscuits are then lifted out with a wire spoon. Better still, a strainer may be fitted in the boiling pan something like that in an ordinary fish-kettle, by means of which the whole of the biscuits boiled at one time can be lifted out at once. They are transferred from the boiling water into another pan of cold water, in which they are allowed to lie for two hours, after which they are strained and baked on wires in a hot oven. When done they should be cupped, glazed on the outside with a bright colour, and soft, dry, and creamy-white inside.

Boiling Process.

Cooling and Soaking.

Baking Cracknels.

A good selling, rather soft biscuit, is made as follows. Use 3 lb. flour (soft), 1 lb. butter, 1 lb. sugar, 6 eggs, 2 oz. carbonate of ammonia, and about ¾ oz. ground ginger. These are rolled round and then flattened out on the baking sheet by hand. They spread slightly and spring thick in the centre.

Ginger Biscuits.

The following is the recipe for a favourite rice biscuit: 4 lb. soft flour, 1 oz. bicarbonate of soda, 2 oz. cream of tartar, 1½ lb. sugar, 12 oz. butter, 12 oz. lard, 8 oz. ground rice, 8 eggs, and 1 pt. milk. The dough is comparatively soft, is not braked in any way, but is divided into pieces the size of the biscuits. These are rolled round and flattened out slightly on baking sheets and baked in a warm oven. They spread slightly, and crack on top.

Rice Biscuits

Parliament Cakes or *Parleys* are another form of old-fashioned biscuit or cake, which was at one time used principally to give to children who came to the baker's shop for the household bread. The dough was invariably made in large quantities, and stocked in barrels to be worked up afterwards as required. The aerating agents were pearlash and alum, used in the proportions of two of the former to one of the latter. The dough was made with about 2 lb. of treacle or syrup to each 3 lb. of flour, and to that about 1 oz. of pearlash and ½ oz. of alum would be added. This dough was not worked up until it was two or three weeks old, and on occasions could be kept for a year. The modern method of making parleys is much less troublesome. Use 8 lb. flour, 2 oz. bicarbonate of soda, no acid, 2 oz. ground caraway. The dough is made stiff with golden syrup: about 5 lb. may be required. No acid is used, because the syrup already has some in its composition. This dough is at once rolled out into long sheets about ⅛ in. in thickness, and cut out with either a round or oblong fluted cutter—docking is not necessary—and placed on baking sheets slightly greased and splashed with water. They are washed over with

Parliament Cakes: Old Method.

Parleys: New Method.

water and baked in a comparatively cold oven. They are quite soft when baked, although an impression made on the surface to try them will disappear if baking is sufficient. They become quite hard and crisp on cooling, and will retain this crispness if kept in a closed tin.

Baking and Keeping.

Scotch Parkins belong to the same family as Parleys. For these the mixture is as follows: medium cut oatmeal, 3 lb.; soft flour, 3 lb.; bicarbonate of soda, 2 oz.; lard, 8 oz.; sugar, 12 oz.; golden syrup, 4 lb.; mixed spice, 2 oz. Dough is made in the usual way, and the pieces for the separate biscuits at once broken off. These are rolled round, then well flattened out on a baking sheet slightly greased and splashed with water. They are then washed over with egg, and half of a split almond is placed in the centre of each. These spread a good deal, and present a marly or cracked appearance all over the top. They exhibit the same signs of being sufficiently baked as parleys, but like them also become hard when cold. They also soften if exposed to the air, especially if the atmosphere is at all moist. Another recipe for Scotch Parkins is: 3 lb. oatmeal, 3 lb. flour, 4 lb. treacle, 12 oz. lard, 12 oz. sugar, 1 oz. bicarbonate of soda, 1 oz. cream of tartar. The mode of manipulation is the same as above.

Scotch Parkins.

CHAPTER XXXII

MEDICINAL AND INVALID BREAD

Many who are troubled with indigestion are advised by medical men to eat bread only that has been well toasted. The toast is at times difficult to obtain, and the requirement of these people soon degenerates into a supply of ready-made toast in the form of *rusks*. The old-fashioned rusks of English confectioners' shops were called *tops* and *bottoms*, and were usually made from plain stale buns left from day to day. These were cut in halves and toasted on baking sheets in the oven, being as a rule turned over so that both sides were equally well browned. The bottoms were, of course, of nearly the same thickness all over; the tops were rounded on one side. When the sale for rusks is considerable, it is better to make a special dough as follows. Make a ferment by whisking together in a jar 1 pt. milk, 1 pt. water —together at 100° F.—4 oz. sugar, 8 oz. flour, and 4 oz. yeast. Allow this to stand in a warm place for about 20 minutes, when it will have risen and dropped. Make a soft dough then with 4 lb. flour (home-milled patent), 4 oz. sugar, ½ oz. salt, 8 oz. butter or lard, and 3 eggs. This dough is then allowed to stand about 50 minutes, and is weighed into pieces about 1 lb. each, and moulded into long flat shapes and placed in long tins, so that the dough is about 1 in.

Toast for Indigestion.

Tops and Bottoms.

English Rusks.

thick. This is proved at an ordinary bakehouse temperature and not forced by steam in any way for half an hour, and then baked in a hot oven. This produces a number of very light, long square loaves about 2 in. deep and about 3 in. wide. These are turned out and kept for one or two days till quite stale, and are then trimmed so as to make them all of equal thickness. They are next cut through the centre, then into little oblong pieces about 3 in. long, 1 in. wide, and ½ in. thick. These pieces are set out neatly and close together on clean baking sheets, and nicely browned in a warm oven.

In making rusks in this way, it is necessary to take care that the dough is not overproved; otherwise it cuts very crumbly. To prevent blisters, and ensure a fine and even texture, the dough is better baked under covers, the width and depth mentioned above, and about 14 in. long; or if only 1 in. deep, then the loaves will not require splitting before cutting into rusks. As malt extract gives flavour to rusks, besides adding to their nutritive value, 1½ oz. of extract may be used instead of the sugar in the dough mixed with the ferment after the latter is ready; or it may be prepared by mixing with 4 oz. of flour and ½ pt. water, and kept for an hour about a temperature of 150° F., then added to the dough at the same time as the ferment. If this is done, ½ lb. more flour will be required in the dough.

To Prevent Crumbling and Blisters.

Malt Extract in Rusks.

In Germany and Holland the trade in rusks is very large, and these really take the place of our biscuits. There the usual shape is round. The rusks are made wholly with milk and of soft dough. Each little piece, sufficient for two rusks, is rolled round and pinned out flat, then baked under an iron cover about 3½ in. diameter and ¾ in. deep. This cover has one or more holes in it to allow the escape of air as the dough proves. When baked, the rusks are like thick soft biscuits the full thickness of the little covers under which they are baked. They are kept in a cool room for about two days, and are then cut horizontally by an ingenious machine into two pieces. These are dried in the oven, as already described. Another form is made in long bars, which are then cut into very thin oblong slices, and after toasting are covered on top thinly with water icing or whipped white of egg, and then with different flavoured sugars.

German and Dutch Rusks.

Mode of Making Rusks in Germany, &c.

It is common for customers to stipulate that the rusks should not be sweet. In this case the sugar in the above recipe may be left out of the dough but still retained in the sponge, the quantity of salt being increased to 1 oz. in the dough only.

Customers who are troubled with diabetes in any form are most particular as to the kind of bread they eat, and although this is, as a rule, obtained from the few bakers who make a speciality of such bread, the ordinary baker is very frequently asked to supply local customers. As this disease requires that neither sugar, nor any starchy matters which the organs can transform

Why Diabetics need Gluten Bread.

into sugar, should be used as part of their food, and as, at the same time, it is necessary that they should obtain as much proteid matter as possible, gluten bread is usually recommended to them, and the baker is asked to supply it. It is possible to make gluten bread of a sort by washing out the gluten from ordinary flour. When this is to be done, take about 1 lb. dough and manipulate it with the fingers in a pail of clean cold water, teasing it out and squeezing alternately until it seems to be free from starch. When this is done, the water with the starchy sediment may be used to mix with the ordinary water for bread. The gluten after washing should be broken into pieces about 2 oz. Each piece is then rolled well between the hands to press as much as possible of the water out, after which it is placed on a greased baking sheet and allowed to stand for about half an hour before being placed in the oven. When ready, the loaves are best baked under covers, and in an oven at a temperature about 360° to 380° F. Pieces about the size mentioned will require nearly an hour to bake, and they should not, if possible, be touched until quite done; otherwise they collapse and are very tough. The use of the covers gives the gluten loaves the pale colour so much desired. When sufficiently baked, and they should be quite hard on the outside, the loaves are placed on one side till cold. They are then cut into thin slices in the same way as for rusks, and toasted quite dry. This toasting is necessary, as the inside is rather stringy and tough. When the slices are cut, and before toasting, they can be dusted over with salt or any desired flavouring substance, as the gluten itself has a very insipid taste.

Preparing Crude Gluten for Bread.

Use of Starchy Sediment.

Moulding Gluten Loaves.

Toasting Gluten Bread.

It is sometimes required to use eggs and butter in the gluten bread, but the incorporation of these things is impossible in the gluten directly washed from the flour as described above. For other reasons it is not quite satisfactory to wash the gluten direct in this way; amongst other things, the resultant bread is usually rather close round the outside with large holes in the centre. It is to get over this trouble that the pieces of gluten are allowed to lie some time after moulding.

Disadvantages of using Fresh Gluten.

Why Gluten is Allowed to Lie.

Fortunately there is no need to wash gluten direct from flour, as there are several quite satisfactory brands of gluten flour now being sold. With gluten flour the following quantities and method will be found to give good results. As only small quantities are usually required at once, 18 oz. of gluten flour is mixed with $\frac{3}{4}$ oz. salt, and 12 oz. butter finely rubbed into it; two eggs are beaten up, and mixed with about $1\frac{3}{4}$ pt. of lukewarm water. The whole of these ingredients are then thoroughly mixed together. As directed above, it is better for the baker without special appliances to make the gluten loaves only small. This dough is allowed to lie for half an hour or so, then is broken into pieces, say, of 3 oz. each. If the hands are kept wet, there is no difficulty in handling the dough. These pieces are

Rich Gluten Bread.

How to Handle Gluten.

rolled round and placed on a greased baking sheet, and a bread pan placed over each; then allowed to lie for half an hour before baking. The oven temperature, as already stated, should not be above 380° F. Three-ounce loaves will take at least two hours to bake, and should not be touched meanwhile. After baking, the loaves are cooled, cut up, and toasted as described above. It is usual to have a quantity of yeast given in recipes for gluten bread, but yeast adds nothing to the lightness but seems rather to make it more sodden. The time of lying after moulding results in softening the gluten, so that when placed in the oven it retains a continuous texture, free from very large holes, and ensures its becoming very light and bulky. A loaf of 3 oz. will form a ball about 4 in. in diameter.

Time Gluten Rolls take to Bake.

Yeast of no Value in Gluten Bread.

Size of 3-oz. Gluten Roll.

Diabetic patients have to eat such insipid things that they are glad to take anything by way of a change from gluten bread. There are mixtures of prepared bran and gluten, and of almonds and gluten, made into biscuits, for which the following recipe may be used. Two pounds gluten flour, through which ¼ oz. bicarbonate of soda and ½ oz. cream of tartar have been sifted, is thoroughly mixed with 3 lb. fine almond meal. One pellet of saccharin is used to sweeten. This will require about 2 pt. milk or water to make into a moderately stiff dough. It is allowed to lie for some time, then pinned out about ⅛ in. thick and docked, and then cut either with a knife or cutter into oblong pieces, and the biscuits baked in an oven about 400° F. Variety may be given to the biscuits by adding ground ginger or aniseed or vanilla.

Gluten and Almond Biscuits.

Bran biscuits are made by mixing 1 lb. of prepared bran with ½ lb. gluten, and making this into a firm dough, using a little salt. This dough is pinned out, docked, cut, and baked as above.

Bran Biscuits.

A very expensive but really palatable small almond cake, suitable for those who can afford the price, is made as follows. The materials used are 1 lb. ground almonds, 20 eggs, and 12 oz. butter. The almonds and the yolks of the eggs are rubbed into a smooth paste in a mixing bowl, and 8 of the egg whites incorporated and the butter also worked in. The remaining 12 whites are well beaten to a froth, and lightly mixed with the paste formed from the other ingredients. The cakes are made very small, and are either baked in patty-pans, which must be well greased, or on greased baking sheets as drops.

Rich Almond Cakes.

For all the goods described above genuine gluten flour should be used. There is an American product offered to the trade as gluten flour which contains a large proportion of starch, and is therefore not suitable for those who require bread free, or nearly free, from starch. The presence of starch in the gluten flour is readily detected by the aid of a drop of weak tincture of iodine: the intensity of the blue colour produced when that is mixed with the flour paste will roughly indicate the amount of starch present.

Spurious Gluten Flour.

Test for Starch in Gluten Flour.

Sometimes bakers are asked to supply cooked flour either for babies'

food or for older people with weak stomachs. Flour contains all the ingredients suitable for human nourishment, and in such proportions as meet the needs of the body; but the gluten of flour, although its most nourishing part, is too tough and tenacious, even when baked in bread, to be easily assimilated. If, however, the flour is carefully cooked in a dry state, the tenacity of the gluten is quite destroyed, and the flour so treated makes a smooth soft paste with warm water or milk, which has a sweet pleasant taste, and is easily digested and assimilated by even the weakest stomach. To prepare flour in this way it is only necessary to spread it in a layer about 1 in. thick on a clean baking sheet, and keep it in an oven about 360° F. (after the bread is all baked is a suitable time) for half an hour or more, turning it frequently while the baking is proceeding. The effort should be to bake it thoroughly without browning. This flour should then be sifted through a very fine sieve, and kept in a close tin or made up in packets for sale.

Babies' Food.

Effects of Baking Flour.

Method of Baking Flour.

CHAPTER XXXIII

BRITISH VIENNA BREAD: MOULDING OF ROLLS

Although crusty bread has been prime favourite in most parts of England for many years, it is curious to note that the manufacture of the crustiest of all varieties, Vienna Bread, has only become general within the last twenty-five years or so, although there were a few establishments in London at an earlier date where it was made in small quantities. Even now it is not extensively used as the bread of the household table, but is in greatest demand in restaurants and hotels, particularly in those conducted or managed by foreigners. But there is little uniformity in the method by which this kind of bread is made, and even less uniformity in character amongst the sorts sold as Vienna. Because this bread is usually glazed, although this is not an essential condition, it is considered justifiable by some bakers to call rolls or loaves *Vienna* if they are only glazed, although they may be made from sweet dough and the glaze applied as egg wash. The matter is further confused by the custom of calling all bread Vienna which is baked and glazed in an oven filled with steam, some of this bread—indeed, the bulk of it—being made after French or German methods rather than after those of Vienna. The former are made from very soft dough, more or less toughened by mixing, and generally with water only; the latter with at least half milk, the dough being stiffer, and the rolls or bread therefore closer in texture, than the first. Those who make Vienna bread in Britain are for the most part German bakers, and in consequence the German

French and German Rolls.

BRITISH VIENNA ROLLS

1. Cut or Potato Rolls.
2. Seed Shoes.
3. Crescent or Horse-shoe Rolls.
4. Floured Batons.
5. Batons.
6. Kaisers.
7. Shells.
8. Seed Rolls or Salt Sticks.
9. Twists.

BRITISH VIENNA ROLLS

method generally prevails. This bread, like French, is very light, the crumb being tough and open, while the crust, especially if only water has been used, is of a bronze-brown colour, and is inclined to be very tough when a day old: if part milk has been used, the crust is lighter in colour and more of a golden-yellow shade. Vienna bread of the finest sort, as made in Vienna and by those in this country who employ Vienna bakers, is smaller in bulk; the crumb is close, but short and not at all tough, and the crust is crisp and free, and remains in this condition even when the bread is a day old.

German Method.

Real Vienna Rolls.

It is usual to make a sponge for Vienna bread, whether of the soft or firm dough sort, but in many cases this preliminary stage is left out and straight dough made, and with quick-working yeast and plenty of it excellent results are obtained in this way. It is not necessary, as some suppose, that only Hungarian, or, as it is sometimes called, Vienna flour should be used in this kind of bread; indeed, for the soft dough sort already referred to, Hungarian flour by itself is not very suitable, but is better mixed with at least half of much stronger flour. Even for the bread made from stiffer dough unmixed Hungarian flour produces very small close rolls, although they may be very sweet and bright, so that for this sort also a mixture of stronger flour is desirable. The class of bread-making flours of top grades now made by our leading mills makes excellent Vienna bread without any admixture whatever of Hungarian. There is, in fact, no need to pay the high price of the latter if a top grade British-milled flour is used.

Flour for Vienna Rolls.

For Vienna rolls of the light sort, such as are sold in restaurants, the following quantities and method may be used. Make a batter sponge with 1 gal. water at 100° F., 8 lb. strong flour, and 6 oz. yeast. It is not necessary to use either salt or sugar at this stage, although the addition of 1 oz. of sugar will cause the sponge to be ready a little sooner. The sponge is made in the usual way. The yeast is first mixed with about 1 pt. of the water, so as to make it into a thin paste, free from all lumps. This is then mixed well amongst the whole of the water, and the sugar, if the small quantity suggested is used, is also dissolved in the water. The flour is then mixed in and well beat up into a very tough batter with the hands, flapping it over and over for the purpose of toughening it, as well as to incorporate as much air in it as possible. A batter sponge of this kind may be very conveniently made in a cake machine, if there is one available. If made by hand, the best utensil in which to allow it to ferment is a deep small oak tub, or an ordinary lard pail, if large enough, suits very well. The sponge should be scraped from the sides of the tub in which it has been made, and then very thickly dusted over the top with flour. This flour will rise as the sponge rises, and it serves very well to keep the top of the sponge from becoming cooler than the remainder, as well as to prevent a skin from forming. The sponge

Sponge for Rolls.

should as a rule be allowed to drop, which will generally occur in about forty-five minutes to one hour after the sponge has been made. For dough, weigh on to the table 14 lb. flour, either home-milled patent, or half Hungarian and half spring wheat American patent. Dissolve 4 oz. salt and 1 oz. sugar in 1¼ qt. of water at 104° F., but do not dissolve these substances until after the water has been used to rinse the tub in which the sponge had been fermenting. Make the dough very thoroughly by pinching and overlapping, so that it becomes quite elastic. This dough is kept in a moderately warm situation, the temperature being as nearly as possible the same as that of the dough itself, and with a small piece of this size it is not difficult to find a corner in the bakery where this condition can be obtained. It is almost needless to say that the dough should be kept covered up to prevent skinning. In about half an hour after making the dough will be ready for kneading, and in half an hour after that it should be ready for scaling. About 3 oz. is the usual size for a roll to be sold in a restaurant for a penny, but owing to excessive competition, and the desire of restaurant-keepers for a larger number for a shilling, the size varies considerably.

Hungarian Flour.

Size of Rolls.

It is usual, where many rolls are made, to have a bun-divider (fig. 14) for sizing the pieces, as a time-saver from weighing them either singly or in pairs. The divider cuts out thirty pieces at once; so for 3-oz. rolls the dough would require to be weighed into pieces weighing 5 lb. 10 oz. When cut out the pieces are usually rolled round first and well dusted with flour, and allowed to lie for ten or twelve minutes before moulding. When moulded the rolls are kept as "green" as possible on the skin; that is, free from flour or cones. This soft dough is best suited for making ordinary round rolls that are slit across the top with a very sharp knife or an old razor blade just before setting in the oven. The instruction given that the rolls are not to be dusted in any way after moulding—unless they are intended for the variety that are floured and partly white after baking—is to ensure that they will take a proper glaze in the oven when steamed, for dust or dry skin prevents glazing, however much steam is used. To the same end the rolls are not proved on dusted boards, but on boards on which are laid fine cotton cloths. On these the rolls are proved all upside down. No dust whatever is needed on those cloths, and however soft the dough may be the rolls will not stick to the cloths, while the surfaces next the cloth will keep soft and moist. If the boards on which the rolls are proving are kept away from draughts, as they should be, it is not necessary nor advisable to place any covering over the rolls, at least none that is in contact with them, such as either a damp or a dry cloth. When ready for the oven the rolls have to be turned over before being placed on the peel.

Bun-divider.

Method of Proving.

Following exactly the same method, a better-class roll is made by using only 2 qt. water in the sponge, with 4 lb. flour, all the yeast, and

1 oz. sugar; then, when making dough, use 2 qt. milk and 1 qt. water, with 1 oz. sugar, 4 oz. salt, and 18 lb. flour. While this dough is quite as soft as the other it will not seem so sticky, and is more suitable than that made wholly with water for making such fancy shapes as Kaisers, Cannons, Batons, &c., but it is still rather soft for producing satisfactory Crescents. Fancy Shapes.

If it is more convenient to make bread from straight dough the following quantities may be used: 40 lb. home-milled patent grade flour, 8 oz. yeast, 5 oz. salt, 3 oz. sugar, 5 qt. milk, and 4 qt. water, both together at 100° F. The dough may require a pint or so more water if the flour is specially strong. After the dough is well made and kept in a warm place for an hour, it should be ready for kneading. After standing another hour, or an hour and a quarter, it should be ready for scaling. The manner of manipulating the rolls after moulding does not differ from that already described. On account of milk being used in this dough the rolls look very bright, and have a sweet pleasant Rolls from Straight Dough.

Fig. 17.—Ends of Vienna Loaves Proving in Cloths

flavour, while the dough is stable and stands a full proof, so that the rolls are large and light. They may require thirty to thirty-five minutes to prove sufficiently.

Vienna bread as made in Vienna is, as already noticed, made from rather firmer dough than that described above, and with other variations in the mode of treatment. It is invariably made with a sponge, an exceptionally large quantity of yeast is used, and the temperature of the dough is kept comparatively low. For bread of this class the following ingredients and method should be used. Make a tough batter sponge by hand with 10 lb. flour, 1 gal. water at 100° F., 2 oz. sugar, and 10 oz. yeast. Beat this sponge well, stretching and folding as much as possible, until it becomes quite elastic, then cover up with a thick layer of flour and allow to stand till it drops. This will occupy about forty to forty-five minutes. Dough is then made with 28 lb. flour—half Hungarian, and half home-milled patents—1 gal. new milk about 80° F., and 5 oz. salt. This dough will be about 76° or 78° F. when finished, and should be kept as near that temperature as possible while proving. It should be kneaded once, and ought to be ready for scaling in about an hour and three-quarters after making. The method of handling after the pieces are cut out is the same as that already described. In this case, however, owing to the dough being stiffer and colder, a longer time must be allowed for the rolls or loaves to prove. The same plan is invariably followed of proving all rolls and loaves upside down on cloths, without any dust; in the case of loaves the cloth is drawn True Vienna Bread.

up between each pair, forming really a double cloth partition, so that they do not touch at all, somewhat as in fig. 17. When the loaves are made very long or in ring shape, they are then proved in cloth-lined baskets specially made for the purpose (figs. 18 and 19), so that when sufficiently proved they can be turned over on to the peel without being handled at all. The shape called *Crescents* or *Horse Shoes* (see Plate, BRITISH VIENNA ROLLS, No. 3) is generally made from special dough containing a proportion of butter—part of the dough just described, with 1 oz. of sweet butter per pound of dough thoroughly incorporated in it. Much care has to be taken that the butter used in bread is perfectly sound and sweet. There being no pronounced flavours of other sorts to mask that of the butter, the slightest rancidity can be easily detected, and the use of butter in such circumstances, instead of being any improvement, is really offensive. After moulding, crescents are best proved straight, and twisted round into horse-shoe shape only when about to be placed in the oven, and this shape is much more satisfactory when baked on tins than if baked on the oven bottom.

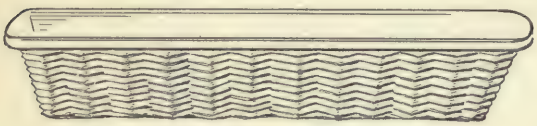


Fig. 18.—Basket for Proving Long Loaves

There is a variety of soft roll made from Vienna dough similar to that used for Crescents, only this dough is further enriched by the addition of 1 egg for each 4 lb. of dough used. The shape of these soft rolls is invariably round, with either a cut on the top or else a split in the centre by being pressed with the side of the hand. They are also proved on cloths upside down and baked on tins, but without steam, in the oven.

Soft Rolls.

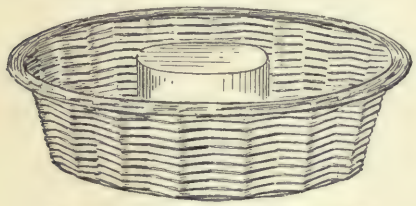


Fig. 19.—Basket for Proving Ring Loaves

Besides the methods and mixtures given above there are all manner of variations of these, not in essentials, but introduced to please the fancy of individuals. It is still possible, however, to have very fine and satisfactory dough and yet to produce very poor Vienna bread. For some of the shapes a good deal of skill and practice are required to obtain good results. The rolls may be spoiled by either under or over proof, but probably the most critical stage of all is the baking. Ordinary shapes, such as round or oval, or long like batons, any baker can produce without special experience, and as these, when nicely glazed and baked, look quite as well as the more fancy sorts, while occupying a good deal less time, it is better, when competition is so keen, to keep to the plain forms. Those of them that require to be cut should be cut clean and moderately deep, and to that end an old razor blade fixed in a plain wood handle is a convenient tool to use for the purpose, or, failing that, a shoemaker's knife, which usually takes and

keeps a very keen edge, will suit. It assists matters, especially when the rolls are soft, if, while the cutting is proceeding, a jug of warm water is placed near, and the knife or razor blade is wetted from time to time. This expedient prevents the dragging which sometimes disfigures soft rolls cut with a blunt knife, or even with a sharp one used dry. It is necessary, however, on occasions to make the more elaborate shapes, especially if customers demand them, particularly the shapes known as Kaisers and Crescents. It is not easy to give instructions as to how these should be moulded, but as there are many who have no opportunity of seeing them made, and must practise with only such instructions as can be given in a book, the task must be attempted.

For all sorts of rolls the usual method is to roll the pieces round first, and to dust them well to prevent sticking, but when they are cut out on a table dividing machine the preliminary rolling is not really necessary. After the pieces have proved a little they are ready for moulding. In moulding a Kaiser roll (see fig. 20) the first operation is to flatten out the piece of dough with the palm of the hand, or the beginner may use a rolling-pin for the purpose, although it is as well to learn to do without this. The piece of dough is then folded over (stage 1) about one-third its diameter; the thumb of the left hand is placed on top of the dough at the doubled part, and the other corner folded over so as to enclose the point of the thumb nearly up to the first joint, and so that the thumb points towards the centre of the roll (stage 2). The thumb is retained in this position, while with the side of the right hand the piece of dough is pressed down. The roll is turned slightly towards the operator and another part of the dough folded over, the corner being drawn about half an inch over the centre, and the dough again pressed along the fold with the side of the right hand (stages 3, 4, 5). This operation is repeated until five folds are made. At the last one the thumb is withdrawn from the position made by the first fold, leaving a cavity there, into which the last corner of the dough is inserted, this corner being forced inwards, and in towards the centre by the thumb of the right hand (stage 6). In moulding this roll there will be, after each fold is made, a corner formed by the folded dough. This corner must in each case be brought over about half an inch past the centre of the roll, the purpose being to make the folds in the finished roll cross each other a little past the centre, and not merely radiate from the centre like the spokes of a wheel. The difficulty the beginner finds with this shape of roll is in getting a neat finish, when the thumb is withdrawn and the last corner of dough inserted in the cavity. The trouble arises usually from the first fold being made too large, or from the last piece being too large. This difficulty is readily overcome by careful practice. The expert moulder does not fold over the pieces with the deliberation described above, but is able by a deft movement of the side of the right hand, which is only acquired with practice, to lift over a piece of

To Mould Kaisers.

Number of Points in Kaiser Roll.

Cause of Bad Finish.

How Experts Mould.

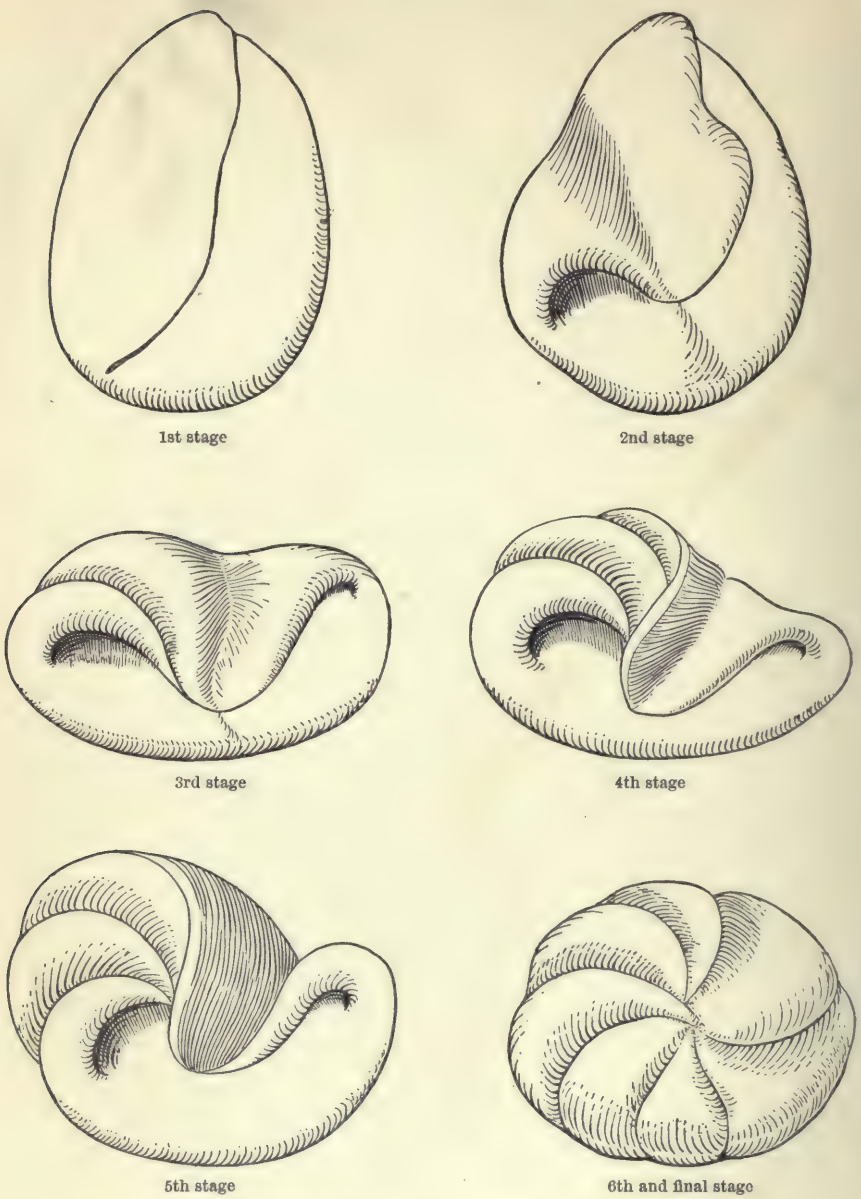


Fig. 20.—Stages in Moulding a Kaiser Roll

the dough and fold it into its proper position, using one of the fingers of the left hand, the thumb of which is in a way imprisoned, to hold each piece as it is folded, until the next piece is placed in its position. The accompanying rough sketches will show the various stages of the roll formation as described. See also Plate, BRITISH VIENNA ROLLS, No. 6.

When the rolls are wanted in the form of shells the moulding operation is much more simple. In this case the piece of dough is beat out quite thin, on one edge only, with the heel of the right hand (1st stage). The thick piece of the dough is then rolled up in the usual way between the hand and the table, until the rolled part is about half an inch from the thinned extremity (3rd stage). With the palm of the hand it is pulled over so that the thinned part will lie flat on that rolled (4th stage), but is not pressed tightly on it to make it adhere too firmly; the purpose of this treatment is to allow the thin part to curl back slightly from the body of the roll during baking. The accompanying

To Mould Shells.

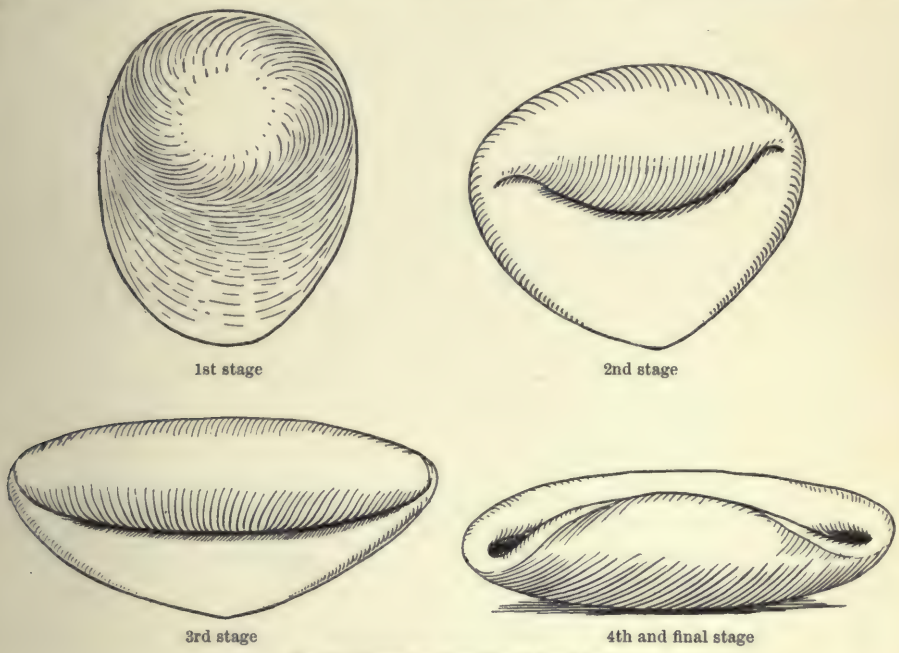


Fig. 21.—Stages in Moulding a Shell Roll

sketches (fig. 21) will show the progress of the moulding operation, while No. 7 on the coloured plate of BRITISH VIENNA ROLLS shows good samples of the finished rolls. After the roll is moulded it is placed, closing downward, on a cloth-covered board to prove, then baked with closing upwards, so that the thin piece opens outwards and curls slightly as already described. This shape of roll has a nice appearance when baked. It can be handled very quickly after a little practice, and does not require very much experience to learn to mould.

How to Prove and Bake Shells.

Probably the most popular shape of roll as made in this country is the *Crescent*, or, as it is usually called, the *Horse Shoe* (see Plate, BRITISH VIENNA ROLLS, No. 3). For this roll the piece of dough has to be pinned out with a rolling-pin. To facilitate this operation it is better to pin several pieces out about half the size they are

Crescents.

wanted, then to allow them to rest for a little before going over them a second time to complete the size. By rolling out at two stages instead of attempting to do so at one the work is done easier and quicker, because the toughness inseparable from fermented dough is not so troublesome when this method is used. When the dough for the roll has been pinned out, until it is about eight or nine inches long, four inches wide at the centre, tapering to about two inches at the ends, and the whole about one-eighth of an inch thick, it is ready for moulding (see fig. 22). The piece of dough is rolled up for about half an inch at top, and the thick part thus formed then fixed (2nd stage) by pressing with the hand. The left hand is used to pull and stretch the small sheet of dough, while with the palm of the right hand the other end is little by little rolled up at the same time that it is also pressed out from the centre, so that the rolled piece becomes wider, while the sheet of dough forming it becomes narrower by stretching, the result of this double action being to cause graduated ridges to be formed all along the roll (3rd stage), while the latter is thin at the two ends and thicker in the middle. The roll as thus finished should be proved on cloth, with the little piece where it was finished downwards, but the roll placed quite straight on the cloth. When sufficiently proved the side next the cloth is turned upwards. The little tag showing the finish should be placed so that its point is towards the interior of the crescent (4th and 5th stages), and care should be taken that these tags all point the one way on the individual rolls, so that all are alike. The rolls are of course turned round into crescent shape when placed on the baking sheet on which they are to be baked.

How to Prepare Dough.

Size of Sheet for Horse Shoe.

Moulding Horse Shoes.

Finish of Horse Shoe.

A shape called the *Cannon* (see fig. 23) is made much in the same way as the crescent; but instead of the dough, as in the latter case, being pinned out into a broad tapering sheet it is for the former shape made into a long string-like piece about sixteen inches long, then flattened out to about an inch and a quarter wide, and an eighth of an inch thick (1st stage). In this case the rolling is not done with the palm of the hand, but from both ends of the ribbon of dough at once (2nd stage), the thumbs and fingers being used, and the dough pressed in the centre of the mass as it grows, while being rolled towards the middle of the ribbon. At the same time this ribbon is stretched as the operation proceeds, so that in the end the piece at the centre will be as thin as possible. This shape of roll may be baked with the two rolls straight and together (3rd stage), in which case the piece of dough between is snipped with a knife or scissors before baking, or one of the rolled pieces may be twisted round and placed so that it forms a right angle with the other (4th stage). The bottom part of the upright half is then pressed with the hand to fix it in this position. The twisting of the roll should not be done till it is about to be set in the oven.

Moulding Cannons.

The illustrations of Vienna rolls given on the plates in this volume will indicate the shapes into which rolls may be made. Except those already

VIENNA FANCY BREAD—I

1. Salzwecken (salt rolls).
2. Mundsemmel (fancy or tasty roll).
3. Salzstriezel (salt twist).
4, 5. Mundbaunzerl (mouth roll).
6, 8. Weisse Wecken (white rolls).
7. Extrawecken (extra rolls).
9, 11. Mohnstriezel (poppy-seed twists).
10. Extrabrot (extra bread).

VIENNA FANCY BREAD—1

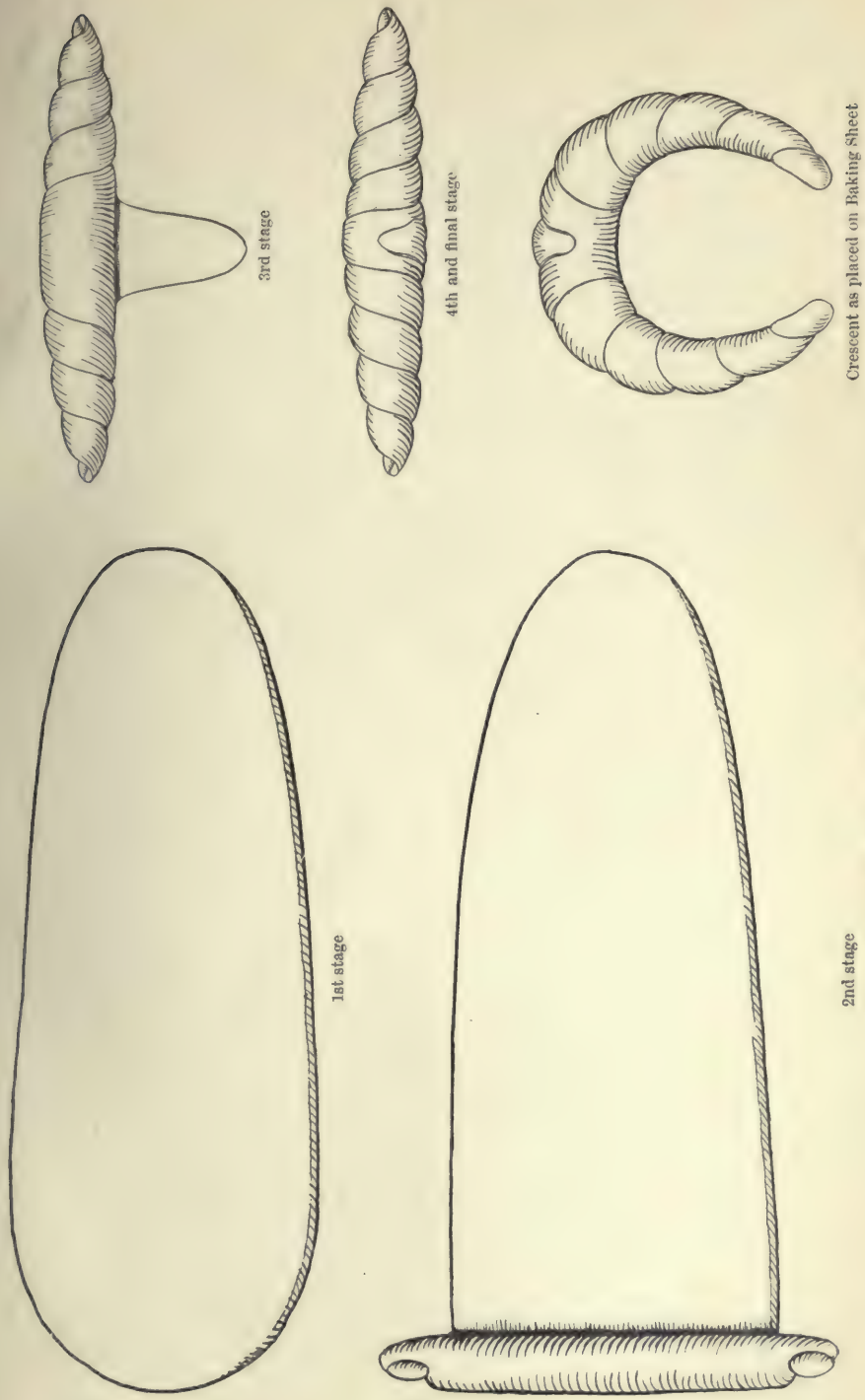


Fig. 22.—Stages in Moulding a Crescent Roll

described few of these require any special skill in their manipulation. Reference has, however, been made to the general practice of allowing these rolls to prove upside down on cloths without any dust on the latter. When the rolls are only small ones, the cloths, which should not be too coarse, are spread flat on the boards; when the rolls are large, the cloths, as already described, are drawn up so that there is a cloth partition between the pieces. By this arrangement the rolls can be proved in the open, without the aid of steam or other heating agent;

Purpose of Using Cloths.

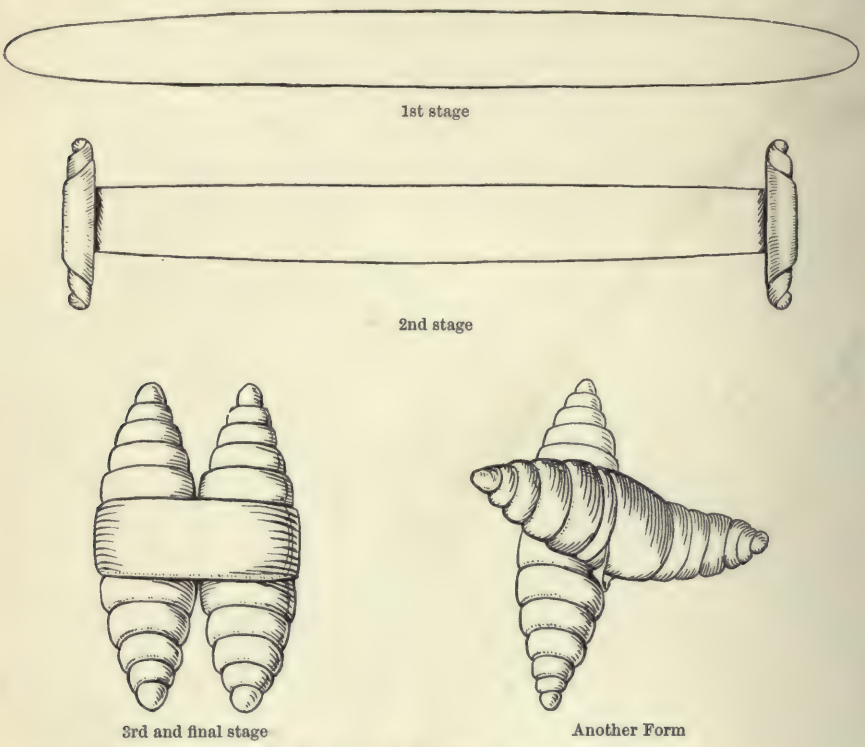


Fig. 23.—Stages in Moulding a Cannon Roll

the side next the cloth, if the rolls are only protected from draught, keeps soft and moist, and is therefore in the condition in which it will readily glaze when steamed in the oven. Rolls proving in this way should not in any circumstances be placed in a prover containing naked steam, as the condensation of the steam will cause them to stick to the cloths. Care has also to be taken that rolls are not allowed to prove too much, or they fail to retain the neat shape given at moulding, do not open out as they should, and are in fact what bakers call *blind*. On the other hand, if not sufficiently proved they are small and pinched in appearance, close in texture, and inclined to be tough.

Must not be Wetted with Steam.

CHAPTER XXXIV

BRITISH VIENNA BREAD: GLAZING AND BAKING

After careful moulding and proving the next point of importance, and in fact the most important point of all, is concerned with the baking of the rolls, especially that part of the baking process during which glazing is effected. It may be stated at once that the glaze on rolls is produced as soon as they are placed in the oven, or at least as soon as this can be effected under the conditions which obtain there. Those conditions are that the oven atmosphere should be saturated or super-saturated with steam, and that the bread to be glazed is completely enveloped by this atmosphere. It may be explained, for the benefit of those not very familiar with scientific matters, that any atmosphere is capable of holding a large quantity of water vapour in suspension without depositing it in the form of water, and that the quantity of water or water vapour thus held depends on the temperature of the atmosphere; the rule being, roughly, that an increase of temperature raises the point of saturation of the atmosphere, that is, the point at which it will hold no more without throwing it down as water. On the other hand, the reduction of temperature of an atmosphere already saturated causes condensation of some of the invisible water it had contained. It is on the principles here stated that the glazing of rolls depends. As soon as the comparatively cold dough is set in the oven with its steam-saturated atmosphere, the air in proximity to the cold rolls is considerably cooled and deposits some of its moisture on them, really covering them with a film of water. The condition required for glazing seems to be that this deposition of water must be continued for some little time after the rolls are placed in the oven, or at any rate that their skins are not allowed to become dry until the glazing process is actually completed. That it is completed shortly after the rolls are set can be seen if one or two rolls are taken from the oven as soon as they can be handled. Although these rolls will be quite white and soft, they are properly glazed, only requiring to be thoroughly dried and coloured as the baking proceeds. What actually happens is, that the film of water deposited on the outside of the roll quickly *boils* this skin, and the gelatinized starch of the flour thus produced gives the glazed appearance.

Glazing Rolls.

Water-saturated Atmosphere.

Effect of Temperature on Saturation Point.

Condensation caused by Cold Dough.

At what Baking Stage Glazing is effected.

It has been already stated that if the rolls are allowed to acquire a dry skin while proving, they will not afterwards glaze properly whatever the quantity of steam in the oven. The same result follows if they are allowed to stand in the oven for only a minute or so in a dry heat before steam is let in. It is this that makes glazing of rolls so difficult in an ordinary oven. Even if there is a moderate supply of steam, part of this escapes every time the oven

Why Glazing is Difficult in an Ordinary Oven.

door is opened, and this part is not merely a quantity taken out of the front near the door and leaving the remainder of the oven full from the crown to the sole, but its escape causes the whole of the steam, or, at least, the saturated atmosphere, to lift several inches from the bottom, and it therefore leaves the rolls for a little free from the moist atmosphere, and they are subjected to a dry heat which causes the quick formation of crust. On this account in an ordinary oven with a swing door it is hardly possible to obtain a sufficient glaze on rolls with such steam-generating apparatus as a pot of boiling water, or steam sets, or even one of the patent generators which produce steam from cold water let into a hot chamber. None of these apparatus produces steam quick enough to compensate for the very large loss each time the door is opened; but in an ordinary oven it is quite easy to glaze rolls and bread if the source of steam supply is a pressure boiler. It has been suggested, not very wisely, that the secret of the success of pressure steam is in its temperature, which, on account of the pressure in the boiler, is hotter than steam at ordinary atmospheric pressure. Thus, while the latter is about 212° F., steam at, say, 80 lb. pressure is about 310° F. But the steam is only at this temperature while it is under pressure, that is, while it is still in the boiler, or in the pipes directly connected with it, but as soon as the pressure is relieved, as soon as the steam emerges from the pipes, it not only loses its comparatively high temperature but becomes colder than ordinary steam at atmospheric pressure. The explanation of this fact is, that as soon as steam under pressure leaves the pipe it expands suddenly and performs work, or uses its energy in pushing back the air, and as the energy in any given amount of steam is quite definite in quantity, therefore what it uses as energy to perform work it loses as energy manifested as heat, and is therefore colder. In an oven, steam from a boiler is not under pressure; before it can be used to glaze bread it has already left the pipes connected with the boiler, and cooled somewhat in the manner just described, although the high temperature of the oven atmosphere prevents the same degree of cooling as in the open air. Since it is undoubtedly true that bread cannot be glazed in an oven with an ordinary door by a small amount of steam, cannot in fact be glazed unless the oven has a direct supply from a pressure boiler, it is interesting to enquire as to the conditions which obtain under such circumstances. As already mentioned the one essential thing is that the oven atmosphere be thoroughly saturated with water vapour, so that the least local reduction of temperature will cause that vapour to change into water and deposit on the nearest cold surface. But in an oven with a swing door which opens down to the oven bottom, it is necessary to open this door to admit each peelful of rolls, and although the opening may only be for a few seconds, the aperture is so large that a great quantity of the contained steam escapes and the whole saturated atmosphere of the oven may rise a few

Boiling Water Supplies insufficient Steam.

Heat of Steam under Pressure.

Heat of Ordinary and Pressure Steam when Released.

Condition of Glazing in Oven.

VIENNA FANCY BREAD—II

1, 3, 4, 5. Butterschnitten (butter slices).
2, 18, 20. Pariserkipfel (Parisian crescents).
6, 7, 8, 30. Mürbe Laibchen (soft loaves or crisp loaves).
9. Pragerspitz (Prague spike).
10. Mürbes Weckerl (soft roll).
11. Mohnstangerl (poppy-seed stick).
12, 13. Gedrehte Kipfel (twisted crescents).
14, 17, 26, 27. Mürbe Kipfeln (soft crescents or crisp crescents).
15, 16. Giraffeln.
19. Mürber Wecken (soft roll).
21, 25. Mürbe Stangerln (soft sticks).
22, 24. Baunzerl.
23. Markus (mark).
28, 32. Radetzky Kipfeln (Radetzky crescents).
29, 31. Murbus Striezel (Murbus twists).

VIENNA FANCY BREAD—II

inches from the oven bottom, this space being filled by comparatively dry air from outside, and if the steam-laden atmosphere is only half an inch above the surface of the rolls it is quite ineffective for glazing. The distance into the oven at which this rise of the atmosphere will take place depends on the time the door is allowed to stand open, and on the rate at which fresh steam is entering the oven from the boiler. It is evident that if the steam can be made to enter as quickly, or nearly as quickly, as it leaves by the open door, then the atmosphere of steam will hardly lift from the oven bottom at all. This is really the condition which obtains when steam is injected into the oven at about 80 lb. pressure. Such a large quantity of water as steam enters in such a very short time that the saturated atmosphere of the oven is kept close down to the oven bottom, and therefore completely envelops the rolls, even when the swing door has to be frequently opened and shut; hence the glazing effects.

Why Pressure Steam Glazes Bread.

When nothing but an ordinary oven is available and Vienna bread requires to be baked in it, there is a certain method of working which must be followed to secure the desired effect. A boiler of at least 40 gal. capacity should be available, and capable of bearing in normal circumstances a pressure of 100 lb. If a very large boiler is available, it is not necessary to have steam at such a high pressure. A word may also be said here about the manner of placing the steam ingress pipe in an oven of this type. The usual thing is to place it along one side and running from front to back of the oven, but greater economy is obtained by having two ingress pipes controlled by a single tap and placed near the back of the oven, running for some distance towards the door along both sides. The pipes should be perforated on top—next the crown of the oven—as they are a constant source of trouble by dripping water if perforated underneath. Before the setting of bread is started, care should be taken that the boiler is nearly full. Water in the pipes connecting the boiler with the oven should be drawn off by the tap usually provided for the purpose. When everything is ready, the rolls or loaves are placed on a broad peel, which should be about as large as the oven door will admit, and with the side of the rolls uppermost that was previously next the cloth on the proving board. The tap admitting steam to the oven is then turned on about one-third its total length until the oven is completely filled with steam. As soon as this is done the man who is handing the rolls on to the peel quickly opens the door, while the setter places his peelful of rolls in the oven and withdraws the peel smartly, when the oven door is at once closed. This operation is repeated as each peelful of rolls is set. In an oven with an ordinary movable light it is impossible to push the light in and out each time the door is opened and shut, and unless the oven is one with a patent light, it becomes necessary to set the rolls in their places virtually in the dark. This is awkward at first, and usually causes

How to Glaze in an Ordinary Oven.

Position of Steam Pipes in Oven.

a waste of oven space, but after a little practice greater accuracy is obtained without much trouble. As soon as the oven is filled with rolls, steam is turned on full, until it begins to come out at the bottom of the oven door, when it is reduced again.

After the rolls have been steamed in this way for about three minutes, the steam is turned off, as there should then be quite sufficient from the baking bread to keep the oven atmosphere completely saturated. If the bread is in the form of rolls, about ten minutes will be sufficient time to allow them to bake in the steam atmosphere. At the end of that time the steam damper is drawn to allow all the steam to escape, and the baking of the rolls is completed in a dry heat. About eight minutes longer, or eighteen minutes in all, will be sufficient time for 3-oz. rolls, if the initial heat of the oven was about 480° F. If the steam is not allowed to escape as described, the rolls, even if they seem hard and well baked when they come from the oven, will quickly soften and become quite tough, and it is to prevent this fault that steam is allowed to escape and baking finished in a dry heat. When the loaves are long ones, or at least are large, and when only one oven fitted with steam is available, it is a common practice to steam, and therefore glaze, those loaves in one oven, and as soon as they can be handled to remove them to another oven in which the heat is dry. In such circumstances the loaves take on a very dark colour in the second oven if its temperature is high. This expedient very greatly increases the baking capacity of the steam oven, as otherwise it would be occupied for a long time with each batch of large bread.

Time Rolls are Baked.

Why Rolls become Soft and Tough.

The method of glazing bread described above may be followed with a side-flue oven if the furnace doors are moderately tight, but if this is the only type of oven available an arrangement should be provided, such as a large fire-block, to cover the end of the furnace as it enters the oven. This plan of baking in steam may be adopted successfully with ovens of Scotch type and with steam-pipe ovens. On account, however, of the large quantity of heat stored in the material of the Scotch oven, it has a larger baking capacity when steam is used than the steam-pipe sort. The latter cools very quickly when such an excessive quantity of naked steam is injected into it. Excellent results can be obtained in a draw-plate oven with an even smaller quantity of steam than in the peel sort, but even in a draw-plate it is not easy to glaze Vienna rolls by the aid of the small apparatus with which they are sometimes fitted which produces steam from cold water. When a draw-plate is in use, the procedure is to fill the plate with the rolls or loaves, keeping the oven door close down meanwhile; then, while the plate is being filled, the tap controlling the steam from the boiler is turned on slightly, so that the oven will be quite filled with steam by the time the rolls are all in position. If the rolls have become in the least dry or skinned, they may be lightly brushed or sprayed with water before the plate is run into the oven. When

Draw-plate Oven for Vienna Bread.

Washing with Water.

everything is ready the steam is turned on about half full and the door lifted just sufficient to clear the tops of the rolls; then the plate is quickly pushed in and the door clamped down tight, at the same time that the steam is turned on full for about three minutes. At the end of that period it is turned off, and the baking continued, in the steam already in the oven and that produced by the bread itself, for ten minutes, after which the whole of the steam is allowed to escape, and the baking for the last eight minutes or so finished in a dry heat. This procedure is in all respects nearly identical with that described for adoption with peel ovens, but the draw-plate gives the great advantage of keeping the oven quite closed till the rolls are all in position, then

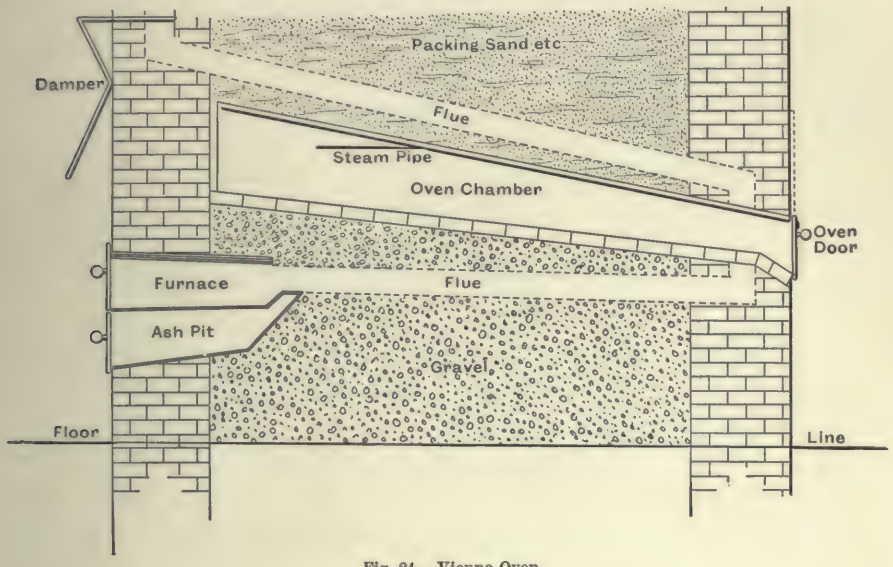


Fig. 24.—Vienna Oven

immersing the lot at once into a steam-saturated atmosphere. There is much less trouble, a smaller quantity of steam suffices, and the glaze is more pronounced than in a peel oven. Still, there is a good deal more steam needed in any of the usual bread types than in a proper Vienna oven (fig. 24). The essential thing about the latter is that it retains any steam passed into it even if the oven door is open. This advantage is obtained by having the oven bottom and top sloping upwards from the door, and by having the latter sliding up and down vertically. By this arrangement the oven chamber is wholly at a level higher than the bottom of the oven door when the latter is open. When the atmosphere of this oven is saturated with steam it remains so, and in the first instance only a very small quantity of water or steam is required to effect this purpose, a few cupfuls of water being, in fact, sufficient if the oven itself is nearly steam-tight. With an oven of this type the use of a small boiler is an advantage, but no great quantity of steam is

Vienna Oven.

needed for any one batch, so that the boiler with very little attention is capable of supplying steam for batch after batch. The small quantity of steam needed, besides making for economy on its own account, has the same effect in another direction, because it does not cool the oven nearly so much as does the large quantity used in an ordinary oven. With an oven of this kind the same precautions have to be taken as when other ovens are used with steam during baking. The bread must be very thoroughly dried; otherwise the crust will become soft after it has been taken from the oven a few minutes. In the case of ovens that are not steam-tight there may be no necessity to draw off the steam from the rolls to finish in a dry heat; but in ovens quite tight this is expedient. Where a large quantity of long loaves are required it is necessary to keep them in the Vienna oven only till they are glazed and set, and the baking may then be finished in an ordinary oven with a dry heat. It is, of course, only possible to build an oven with a sloping bottom for Vienna bread when there is a reasonable prospect that there will be sufficient trade to keep it going for that kind of bread alone, as the sloping bottom makes it unsuitable for bread of the ordinary sorts. (A full description of various designs of this and other types of ovens will be given in a later chapter, with drawings.)

Quantity of Steam Needed.

There are thousands of bakeries where it is impossible, from the want of steam, or facilities for producing it, to make Vienna rolls or bread by any of the methods described, and yet, to give variety to the window display, or to supply bread for a special occasion or for a special customer, most bakers are anxious to be able to make rolls that have at least a presentable likeness to the real article. To this end more or less simple expedients have to be resorted to. The very simplest, and not the least effective, is to carefully wash over the rolls or bread after they are properly proved with ordinary egg wash. The rolls are moulded as neatly as possible in the manner described, and proved on cloths; then when ready they are turned over and placed evenly on tins, after which they are washed and baked in a moderately warm oven in the usual way. The wash should not be wholly egg, but may consist of two parts egg to one part milk. It is necessary to break the grain of the yolk thoroughly and destroy by whisking the fibrous nature of the white of the egg before mixing with milk. A soft brush should be used for washing over the rolls; otherwise they will be streaky and look far from enticing. Rolls or loaves that are washed in this way are best baked on tins, for, if baked on the oven bottom, the under part appears dry and coarse, while the upper part is bright and glossy. When baked on tins the rolls flatten out slightly on bottom. If this is a fault it can be got over to some extent by heating the tins highly before placing the rolls on them, then setting them in the oven quickly. When this is to be done it is better to lay the rolls first on a board to wash them, and place them on the hot tins afterwards; this prevents the tins from cooling too much before they are again in the

Egg Glaze for Rolls.

Preparing Egg Wash.

Why Baked on Tins.

VIENNA FANCY BREAD—III

1. Brioche.
2, 8. Gallatschen.
3. Gedrehte Brioche Stangel (twisted Brioche stick).
4, 5, 6. Theestangel (tea sticks).
7, 9, 19, 21. Dessertweckerl (dessert rolls).
13, 16. Briochen Formstangel.
10, 11, 14, 15. Dessertlaiberl (small dessert loaves).
12, 17. Karlsbader Brezel (Karlsbad crackers).
18, 22, 25, 27. Briochekipfel (Brioche crescents).
20. Briochestriezel (Brioche twist).
23, 26. Stolle—*sometimes called* Weihnachtstolle (Christmas currant bread).
24, 28. Brioche Markus (Brioche Mark).

VIENNA FANCY BREAD—III

oven. Rolls that have been glazed with egg have an appearance not unlike that obtained by steam, but the resemblance ends there. The crust is soft and has not the same crispness nor the sweetness of rolls baked in steam. Egg wash may also be used for large loaves, but those are best baked on the oven bottom. After proving thoroughly on cloths the loaves are turned over and carefully glazed with a soft brush, and are cut only after they are placed on the peel or on the draw-plate.

Character of Egg-glazed Rolls.

Instead of using egg wash, which is relatively expensive, a cheaper wash may be manufactured from either wheaten or corn flour, preferably the latter, as it is easier to prepare free from lumps. This wash is identical with that described for use on plain crusty bread, only made a stronger jelly. For this purpose $1\frac{1}{2}$ oz. of wheaten flour or $1\frac{1}{4}$ oz. of corn flour to 1 pt. of water is used. The most satisfactory way of preparing this is to mix the whole of the flour and water together into a thin milky fluid, then boil, stirring during the process, in a saucepan of water until the paste becomes brownish in colour and thickens. This is allowed to cool, then it is well stirred until it becomes a thick paste and its jelly-like nature destroyed. Owing to its thickness this paste is not very suitable for use on small rolls, as they so readily move about under the brush, and are in consequence very liable to be streaky, but it suits very well indeed for larger loaves. These are manipulated and proved in the usual way, but are given a smooth coat of the prepared paste before being placed on the peel and before cutting. This application is not sufficient, however, to effect the necessary glaze. In the same way as described for rye bread the loaves must be drawn from the oven after they are quite set, but before baking is completed, and washed over a second time, then returned to the oven. If the latter is moderately warm this second application is generally sufficient to produce the proper glaze, but if not it is only necessary to wash over with a little clean water when baking is quite completed to secure that end. Bread glazed with gelatinized starch paste in this way may be made to appear quite like that glazed with steam; indeed, glazing is effected in both cases in much the same way. When bread is steamed the outer skin of the dough is scalded and its starch gelatinized; in the other way just described the gelatinized skin is, as it were, prepared separately and smeared on with a brush. The paste-glazed rolls have neither the crispness nor the sweetness of the steamed. The former incline to be harder and drier, owing, no doubt, to the heat of the oven being dry during the whole time of baking. When, however, Vienna bread is made only for show purposes or for special orders, when no proper facilities are available, glazing in this way with paste is as good an expedient as any.

Cheap Wash for Bread.

Preparing Starch Wash.

Why Rolls become Streaky.

Starch Glaze compared with Steam.

There is another method of preparing small quantities of Vienna rolls by actual steaming and without any special wash. Glazing in this case is effected with steam. If some rolls, moulded and proved as already

described, are placed on an ordinary flat baking sheet, are well splashed with water, and are then baked in a hot oven under inverted bread tins, these rolls will take on the characteristic glaze of Vienna bread. As soon as the glaze is produced, which will be when the rolls are in the oven about ten minutes, the baking may be completed without the covers. The rolls will have all the appearance and taste of proper Vienna rolls, except that they will be somewhat flat and have sharp edges at the bottom, with a tendency there to hardness. Matters are improved by heating the baking sheet well before placing the rolls on it, and using hot water for splashing. This expedient is, of course, only suitable when a very few rolls have to be made. For larger quantities special tins with lids which are more or less steam-tight may be used. Those generally in use for baking cream buns are very suitable, or those now sold for baking exhibition crusty bread; but whatever sort of tin is in use it is better that the deep part should form the lid, so that before the steam can escape it must completely fill the tin and therefore envelop the rolls. In the case of the cream bun and the other tins already alluded to, this condition is best obtained by using the lid of the tin as the bottom on which to place the rolls, and the body of the tin as the lid. By doing this, steam cannot escape until it has reached the bottom. The success of this method of baking depends on the amount of water used. There must be enough in the tin to quite fill it with steam before the heat causes the rolls to skin. On the other hand, if too much water is splashed into the tin the effect is to make the rolls hard and their skins tough. If the tins are reasonably tight it is sufficient merely to wash over the rolls with water, after placing them on the tin, which has previously been heated highly. A very little water sprinkled over before the cover is placed on will produce all the glaze necessary. As in the other cases it is best to complete the baking of the rolls in a dry heat, that is, without the covers. Of all the expedients for imitating Vienna rolls, the best results can be obtained by this method; and with two or three tins, used only for baking up to the glazing stage, sufficient rolls can be made for an ordinary shop trade.

Steaming under Covers.

Glazing in Boxes.

How to Prepare Rolls for Steam Boxes.

CHAPTER XXXV

CONTINENTAL VIENNA BREAD

Bread on the Continent is of endless variety, as far as its composition and outward form are concerned; but fancy bread, which figures largely on the breakfast tables of the well-to-do classes in Austria-Hungary, Germany, France, Italy, Spain, Belgium, and Holland, is to a great extent modelled on the Vienna lines. The capital of Austria sets the fashion as completely in rolls and fancy bread as Paris

Fashion in Continental Bread.

forty years ago dictated what bonnets ladies should wear. A Budapest miller once remarked to the writer, "We in Budapest know how to make flour, but if you want to eat the perfect bread you must go to Vienna." Without unreservedly endorsing this judgment, it is undoubtedly true that Vienna bakers have brought the art of making light rolls almost to perfection. All over the Continent the shapes of rolls peculiar to Vienna are copied, with such modifications as local taste demands. A Continental wayfarer may look into bakers' windows in the fashionable quarters of Berlin, Dresden, Munich, Cologne, Brussels, and Paris, and he will see the same kinds of fancy bread as he admired in Vienna.

Perfection of Vienna Bread.

The illustrations to this article, so far as they are concerned with rolls and fancy bread made in Vienna, are reproduced from photographs specially taken in that city. This bread was all prepared by Herr Josef M. Breunig, of Vienna, who holds by warrant the appointment of Baker to the Emperor-King, as his Majesty Francis Joseph is officially styled.

The Emperor-King's Baker.

Among the fancy rolls of Vienna none has acquired wider vogue on the Continent than the *Semmel*, a dainty little roll, round in shape, and always so moulded that the top has a sort of distant likeness to a sea anemone closed, with wavy lines radiating from the centre, which in the anemone would be the closed mouth. This pretty little roll is also known in Vienna as a *Kaisersemmel* (see Plate, VIENNA FANCY BREAD — IV, Nos. 8, 9, 14, 16), or a *Mundsemmel* (see Plate, VIENNA FANCY BREAD—I, No. 2). The former description doubtless implies a roll fit for an emperor's table, whilst the latter variety of Semmel is usually small enough for one mouthful. *Mund*, be it noted, is German for *mouth*. The Vienna Semmel is supposed to be prepared from Hungarian top patents, but different qualities of these rolls are made in Vienna as elsewhere. A Viennese recipe for making Semmeln recommends the addition to 100 kilos of flour of 3 kilos of brewers' yeast (roughly $6\frac{3}{5}$ lb. of yeast to 2 cwt. of flour). This mass is doughed by means of 40 to 50 litres ($4\frac{1}{2}$ litres go to the gallon) of water and milk in equal proportions, and the dough is kneaded in the usual way, care however being taken to add sufficient flour to make a moderately stiff dough.

Kaisersemmel.

The Mund-semmel.

Recipe for Semmel Dough.

Vienna bakers attach a good deal of importance to the temperature of the bakehouse; for instance, rolls on leaving the moulding board are supposed to be proved for a little while in a temperature of about 85° to 95° F. before being put in the oven. They are proved on long boards on fine cloths placed on hanging racks above the bakers' heads. The poorer the flour (by which presumably lack of strength is meant) the higher should be the temperature of the proving room. When flour of lower quality is used the dough should be stiffer. Not infrequently the so-called *Vienna yeast* is used in place of brewers' yeast. This is a ferment prepared

Proving Temperature for Rolls.

Influence of Quality of Flour on Rolls.

from hops. To 100 kilos (2 cwt.) of high-class flour 12 litres (roughly 2 gal. 5¼ pt.) of this ferment may be added; for poorer flours 2 gal. would be ample. This ferment, moreover, should be diluted with 25 to 30 litres (about 5½ to 6¾ gal.) of warm water about 100° F. The sponge may then be allowed to rise and drop. When the sponge has dropped, 25 to 30 litres more of warm water may be added, and sufficient flour to form a firm dough which will not work too quickly. Many Viennese bakers prefer this process as giving a more stable dough, a point to which they attach some importance. In preparing the sponge they are careful to heap up the flour at one end of the trough, forming at the same time a hollow in the middle, into which the liquid ferment is poured, till the latter has been thoroughly absorbed by the flour, an operation which is hastened by pushing down the flour in little masses into the cavity. As soon as the water has been thoroughly absorbed by the flour the kneading can begin; this operation should be taken in hand gently at first, the pressure being increased towards the end. When the dough has been worked stiff the warm water can be gradually added. Working in the water in this way makes the dough very elastic.

Vienna Yeast.

Ferment with Vienna Yeast.

Method of Mixing and Kneading Dough.

In South Germany bakers who make rolls, such as the popular *Wecken*, of which several illustrations are here given, usually begin making up the sponge about noon. This is made slack, with flour, barm, and water, and is allowed to ferment in a rather high temperature for six to nine hours, when more flour is added. In about an hour the kneading is begun, and two hours afterwards the rolls are moulded and ready for the oven. As a rule, with 100 kilos (2 cwt.) of flour, 60 litres (between 13 and 14 gal.) of water and ·25 kilo (rather over ½ lb.) of yeast are used. The same kind of roll is sometimes made with milk, when the same process is followed, except that milk takes the place, in about the proportion of one-half, of water. Not infrequently butter is used as well as milk, the usual proportion being 1 kilo (2·2 lb.) of butter to 18 litres of milk.

South German Methods.

Butter in Rolls.

A characteristic Vienna roll is the *Wecken*, of which various kinds are shown on the plates of VIENNA FANCY BREAD, I–IV. The name has many variations, being also written and pronounced in different localities, *Weckel*, *Weckle*, *Weckerl* (as in Vienna), *Weckchen*, and *Weck*. The Wecken in its original shape is a small elongated roll with rather sharp points—in fact, a sort of miniature Vienna roll, as made in London. In Vienna, and over Austria generally, the Wecken is usually a plain-shaped roll, without lines or indents. Sometimes there is a strong line of demarcation down the centre, as in the *Salzwecken* (see Plate IV, No. 3). We have seen in Germany neatly moulded double Wecken, forming two perfect little rolls joined in their whole length. Sometimes the Wecken is indented at the top with a Maltese cross. Like other Continental fancy bread, the Wecken is made either with

The Wecken Roll.

German Wecken Roll.

VIENNA FANCY BREAD—IV

1. Kaiserweckerl (Kaiser roll).
2. Barches (twist).
3. Salzweckerl (salt roll).
4, 6. Kaiserlaibchen (Kaiser loaves).
5. Mohnkipfel (poppy-seed crescent).
7, 10. Französerln (small French rolls).
8, 9, 14, 16. Kaisersemmel (Kaiser rolls).
11, 12. Erdäpfel Wecken (potato rolls).
13, 17. Salzstangeln (salt sticks).
15, 19. Französische Wecken (French batons or rolls).
18, 20. Wasserkipfel (water crescents).
21, 23. Patentwecken (patent rolls).
22. Kaiserwecken (Kaiser rolls).

VIENNA FANCY BREAD—IV

or without milk. The *Wasserwecken* is a plain roll made from an ordinary dough, whilst the *Milchweckchen* (Plate V, No. 1) is prepared with milk. Again, an *Eierweckel* has a golden tinge from the use of eggs, and soda is used in making up a *Laugenweckle.* Water Wecken and Milk Wecken.

Another favourite shape of breakfast roll is the *Laibel*, known in Vienna as *Laiberl* (see Plate, VIENNA FANCY BREAD—III, Nos. 10, 11, 14, 15). This is a small round roll, frequently quite plain, but sometimes with a deep cut or crease through the centre. It is also known as a *Mundlaibel* (Plate I, No. 4–5). In Munich a similar kind of roll, but of oblong shape, with a very round face, and indented with a Maltese cross, is known as a *Viezerl.* Laibel Roll.

Crescents (see Plates, VIENNA FANCY BREAD, II–IV) and *Horse Shoes* are in great request all the Continent over, and are made up with and without milk. In Brussels crescents are made up with a lot of butter, and are not at all unpalatable, though we imagine their constant consumption would require a sound liver. The crescent is known to the bakers of Austria and Germany as a *Kipferl* or *Kipfel.* It is made up in any number of ways. Twisted, it is known in Vienna as a *gedrehtes Kipfel* (Plate II, Nos. 12 and 13). When the horns of the crescent are wide apart it is termed a *Pariser Kipfel* (Plate II, Nos. 2, 18, 20), from its resemblance to the croissant of Paris. When the points almost meet the name changes to *Damenkipfel*, or ladies' crescent. We are now using the terms current in Viennese bakeries. The *Hörnchen*, which has much resemblance to a horse shoe, is found all over the Continent. The *Plunderhörnchen* and *Nusshörnchen* are names used by the leading bakers of Dresden, and typical specimens of the Hörnchen are largely displayed in bakers' windows in Germany and Austria. In the capital of the latter country, however, the Hörnchen is often known by the name of Kipfel. Kipfel Roll. Dresden Hörnchen.

All these fancy rolls may be sprinkled on the top with aniseed or any other kind of seed. Hence we get *Kümmelbrot, Kümmelwecken*, and so forth. Both in Germany and in Austria a piece of fancy bread which is in considerable request is the *Bretzel*, or *Pretzel*—the *t* is sometimes omitted. To form a Bretzel the baker takes a string of dough and twists the ends round till they cross one another, when they are twined together and then pulled apart, each of the two ends being drawn to opposite sides of the circumference of the circle which has thus been formed. The Viennese specimens we illustrate are good examples of the Bretzel (see Plate, VIENNA FANCY BREAD—III, Nos. 12, 17). The Dresden *Plunderbretzel* is also well moulded. It is worth noting that the ends of a Bretzel are generally moulded into snakes' heads. The figure of a curled-up snake is a mystic emblem, believed to signify immortality—"that which has no beginning or end"—and is said to be thousands of years old. It is not to be supposed that the consumers to-day of Bretzeln are mystics in any shape or form. These small goods are almost invariably highly glazed, and are usually well Seed Rolls. Bretzel.

flavoured with salt. They are said to be in great favour with purveyors of malt and other liquors, who judiciously strew them about the counter as thirst-awakeners. Not that the Bretzel is peculiar in being seasoned with salt. In many districts of Austria and Germany salt is highly relished as a bread condiment; hence the *Salzwecken* (Plate I, No. 1, and Plate IV, No. 3) and *Salzstange* (Plate IV, Nos. 13, 17), or *Stangerl*, which are in such wide request. The latter is a roll shaped like a slender rod.

Salt Flavour of Rolls.

To describe fully all varieties of Continental fancy bread would take more space than can here be spared, but we may call attention to the partiality of the Viennese for all kinds of twists. Not only the Kipfel, but Wecken, Stangel, and many other sorts of fancy bread are more or less elaborately twisted. Good examples are the *Striezel* and *Markus*. The *Briochestriezel* is a very elaborate piece of work, as may be seen from our illustrations; it is rather cake than bread. See the plates of VIENNA FANCY BREAD.

CHAPTER XXXVI

CONTINENTAL COMMON BREAD: BELGIAN, FRENCH, AND GERMAN

It would be a great mistake to suppose that the people on the Continent consume only the dainty rolls which are served to tourists at hotels with the morning cup of coffee. It is true that Vienna rolls and small goods have made the tour of Europe. They have made their way to Belgrade, Sofia, and Constantinople, and in the better found hotels of those capitals they may be enjoyed in perfection. The masses, however, neither in Eastern nor Western Europe, live upon rolls and buns. Far from it. This is not a political article, but truth compels us to say that the British working man is better off as regards his daily bread than nine-tenths of his brother workmen on the Continent. This is true both of quality and of price. The best value we have seen in bread on the Continent, speaking, that is to say, of household bread, was in Holland and Belgium. We believe that to-day the price of bread in Holland is about the same as in Britain. At any rate a careful comparison of very recent prices has failed to show any essential difference. In Belgium bread is tolerably cheap. An import duty, nearly equal to 2*s*. per sack of 280 lb., is levied on foreign flour, but wheat is free, and the competition of the Belgian millers is severe enough to keep prices at a moderate level. The import duty on foreign flour was imposed in 1895 to meet the bounty-fed competition of French flour. In those days the Belgian miller was crying out that he was being ruined through the French system of granting a drawback to exporters of flour. This drawback was regarded in Belgium as a virtual bounty, and as the drawback system was then administered

Continental Common Bread.

Belgian Millers and French Bounties.

VIENNA FANCY BREAD—V

1, 3. Bosniaken (Bosnian loaves).
2, 8. Grahambrot (Graham bread).
4, 6. Geschnittene Schusterlaibchen (cut shoemaker's rolls).
5. Molkinbrot (whey bread).
7, 9. Schwarzbrot (black bread).
10, 12. Glatte Schusterlaibchen (smooth shoemaker's rolls).
11, 13. Croutonbrot (crust bread).

VIENNA FANCY BREAD—V

in France, we believe this charge was not unfounded. But the duty of 2 francs per quintal (roughly 2 cwt.) imposed in 1895, had the effect of reducing an average import of 630,000 sacks (taking 1889–95) to a yearly average of 120,000 sacks (1896–1902).

That Belgian bread is, however, sensibly lower in price than French is made clear by one curious fact. Along the Franco-Belgian frontier have sprung up many considerable bread factories, but all are located on Belgian soil. It so happens that in France dwellers on the frontier are allowed, on crossing the frontier, to bring back duty-free a certain amount of bread or flour. This concession, illogical, it must be admitted, in a protectionist country, has been made in the interest of the large working-class population who live sufficiently near the Belgian frontier to be constantly crossing it in search of work. That the boon thus accorded is very real is proved by the large trade done in France by these Belgian frontier bakeries; in fact, for years past the French government has been besought by millers and bakers alike to put an end to what they describe as "the scandal" of this frontier traffic. Oddly enough, the same indulgence has been extended to its frontier subjects by the ultra-protective government of Germany. The result has been just the same as in France. The Imperial German government has been petitioned by the Association of German Millers to stop or restrict the free importation of bread and flour across the frontier, but has not seen its way to interfere.

Smuggling Bread on Belgian Frontier.

Belgian Bread

Returning to Belgium, we find excellent household bread. The loaves have a great similarity to bread of the same class consumed in the north of France. We never remember having eaten more palatable bread than in some parts of Belgium, which is a great bread-eating country. Though its production of wheat is insignificant (between 1,500,000 and 2,000,000 qr. per annum), it is a free importer of Danubian and La Plata wheats, as also of American, when the latter are in the market. The shapes of bread favoured by Belgian bakers are mostly elongated; long rolls with diagonal cuts on the top (see Belgian Roll, Plate Scotch and Fancy Bread) are much in evidence. Belgian bread is made on the same system generally as English, compressed yeast being almost universally used. In the mining districts of Belgium the quality of common bread is very fine. Miners are everywhere remarkable for their insistence on the best bread. In their standard of goodness is almost invariably included a very white loaf; that is to say, they make a great point of colour. But they are not content with mere whiteness. In the mining districts of Belgium much the same kind of bread is in demand, so far as colour and strength are concerned, as in the Rhondda valley, where the miners, it is said, will have, and are ready to pay for, bread a good deal above the average. At St. Étienne, a great

Belgian Bread.

Belgian Miners and Good Bread.

French mining centre, there is the same demand for fine, white bread, though French millers have not the same choice of strong wheat as their Belgian brothers.

French Bread

France grows practically all the wheat it consumes—about 43,000,000 qr.—a duty of 12*s.* 2*d.* per qr. of 480 lb. excluding all but 1,500,000 qr. of imported wheat. French wheat is not unlike British in many respects, but is certainly not remarkable for strength. After a wet harvest the flatness of loaves throughout the country is very noticeable. For all that it is remarkable what good bread is made in France under normally favourable conditions. Such grand domes as are quite usual on English household bread are not to be found in France, but notwithstanding the absence of strong wheat some well-piled loaves are to be seen in Paris and other great cities. Household bread is known in France both as *pain de ménage* and *pain ordinaire.* (See Plate, French and Dutch Bread.) The shapes of loaves vary a good deal in different parts of France, but in Paris long rolls, more or less cut on the top, are much in evidence. Another shape is a loaf somewhat like a sole, rather flat, and generally marked with diagonal cuts. In country districts we have seen large round loaves, close in texture and not over-appetizing in appearance. Though distinctly stodgy, this bread had the merit of cheapness, the price being below that of the ordinary bread to be bought in this country. But putting aside farmhouse bread and loaves from the village bakehouse, bread in France has been kept in price at a distinctly high level during the past twenty years. In the well-to-do quarters of Paris the price of bread has in recent years often reached 8*d.* the quartern. Of course this is top price bread, but the official returns of the mean price of first-quality bread for all France from 1882 to 1901 show that the average of only one year (1900) fell below 30 c. the kilo, which is nearly 6*d.* the quartern. In 1900 the average dropped to 29 c., or about 5½*d.* the quartern. In many of these years the average rose as high as 7*d.* per quartern, and in some years this average was exceeded. A pretty French loaf is known as a *couronne*; it is circular in shape, and is moulded at the top in ornamental scrolls, somewhat like our wedding cakes. We have seen some fine specimens from the north-western departments of France. The use of rye bread is apparently dying out in France, except in certain parts of the country. The rye loaves are usually round and rather flat, with diagonal cuts across the top. The French peasant likes his rye loaf thoroughly baked. Though rye bread and loaves from coarsely ground wheat flour are still to be seen in parts of rural France, the typical Frenchman prefers a white loaf. Twenty-five years ago the peasant was still content, to a great extent, to eat dark bread, but to-day things are greatly changed in this respect. The land is now covered

French Bread.

Shapes of French Bread.

Prices of Paris Bread.

French Rye Bread.

with roller mills from north to south, from east to west, and in small villages in typical rural districts white bread is often to be seen. It is noteworthy that the cult of brown bread has made little headway in France. The mass of Frenchmen have no liking for dark-coloured loaves. This may be explained by the fact that French bread in the main is of agreeable flavour; French wheat has a good deal of sweetness about it, and the bulk of the bread baked in France recalls the best specimens of English bread made from blends into which entered a generous proportion of Norfolk or Cambridge flour. In this land of ours a good deal of the popularity of the darker-coloured patent breads seems attributable to the malt extracts and other preparations with which most of them are flavoured.

German Bread

In Germany rye bread is still in considerable vogue, and the taste for it is by no means confined to the poorer classes. Whatever may be his breakfast fare to-day, Kaiser Wilhelm some years ago would have no Kaisersemmeln on his table; such airy trifles were not to the taste of this strenuous ruler. His breakfast rolls, known in Berlin as *Knüppel*, were prepared from a mixture of wheat and rye flour. These rolls are rather small and round; they have somewhat the appearance, minus the sugar, of the Berlin dough nuts which are a familiar object in London bakers' windows. The Knüppel, however, is smaller than an ordinary dough nut. The flavour of rye bread or of bread into the composition of which much rye has entered is very characteristic, and perhaps would not commend itself to every English palate, although at one time rye bread formed a good part of English working men's diet. But tastes, as the Romans said, are not a matter of argument.

German Rye Bread.

Knüppel Rolls.

With a population of 60,000,000 Germany only raises, according to official statistics, between 15,000,000 and 16,000,000 qr. of wheat, as compared with some 42,000,000 qr. of rye. On the other hand, the mean imports of wheat—of course we are not speaking of the abnormal imports of the first half of the 1905–6 cereal year—are about double those of rye. It is very clear that rye still plays a most important part in the feeding of the German people, though it by no means follows that all the rye raised is used in bread-making. Everything points, however, to the conclusion that Germans are consuming more and more wheaten bread. A typical German dark rye bread is the *Pumpernickel* of Westphalia. The loaves are usually shaped somewhat like a fish torpedo, with not too high a dome. On cutting the loaf a very dark colour is disclosed, which is to be expected of the coarsely ground rye from which this bread is made. In preparing Pumpernickel a certain amount of rye meal is placed in a wooden trough and made into a thick paste by the addition of a suitable proportion of boiling water. After a preliminary kneading the dough thus formed is left for some time in the trough at a fairly high temperature.

Pumpernickel.

No yeast has so far been used, but in time a certain fermentation sets up in the mass, and this may be quickened by a further mass of dough and a small amount of barm being kneaded into the first dough. When brought to the proper consistency, which should be very firm, the dough can be moulded into loaves, which often exceed 6 lb. in weight. The loaves undergo two bakings; the first time they are put in the oven they are only kept long enough to allow a crust to form and the crumb to set, on which they are withdrawn, and each loaf is sprinkled with water on its upper surface. As soon as this operation is completed the oven is recharged, great care being taken to keep the door tight, and the batch is baked in three to four hours. The result is a loaf heavy in more than one sense of the word, but with a not unpleasant taste, at least according to the writer's palate.

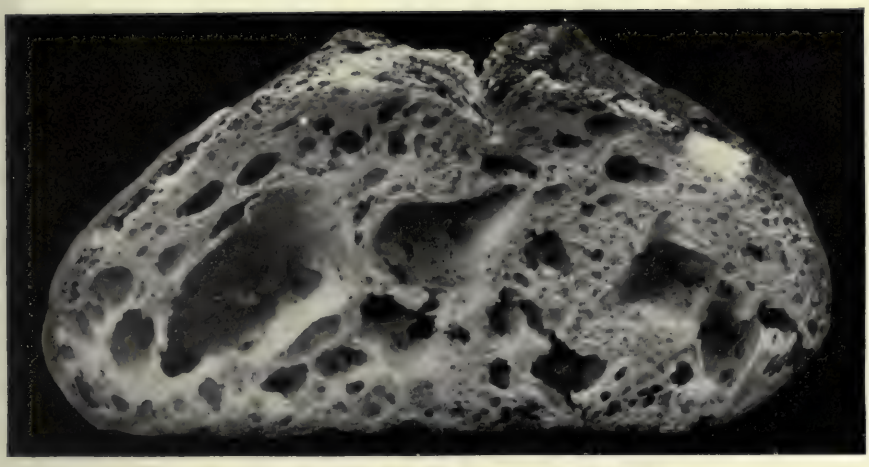
Sometimes, we believe, Pumpernickel is made without any barm at all. The sprinkling or washing of the loaves when half-baked produces the characteristic glaze like varnish. Much the same process used to be followed in Prussia in preparing soldiers' bread, known as *Kommisbrot.* A mixture of rye meal and rye flour was used for Kommisbrot; a sponge, of which the basis was about 44 lb. of dough kept over from the previous doughing, was the only ferment used for this sort of bread, while to the dough a small amount of salt was added. Each loaf was supposed to weigh 1½ kilo, or about $3\frac{3}{10}$ lb.

Rhenish Black-bread.

In some parts of Rhenish Prussia a very black bread is made, known as *Rheinisches Schwarzbrot,* or, as we should say, Rhenish Blackbread. Its constituents are rye meal, coarser even than that used for Pumpernickel.

Milling Rye Flour.

It must not be supposed that all the rye bread consumed in Germany is dark. The milling of rye is a great industry in that land and in Austria, and large merchant mills have been erected in both countries for the production of rye flour of different grades of fineness. Rye flour is made by machinery having considerable affinity with that used for flouring wheat, but rye-milling and wheat-milling are distinct processes and need separate plants. Not infrequently German household bread, known as *Hausbrot* or *Tafelbrot,* is made from a mixture of rye and wheat flour; such bread is termed *Halbweissbrot,* or whitey-brown bread. We have sampled rye bread made from fine flour which cut an excellent colour, but invariably a rye loaf, or a loaf into which any proportion of rye has entered, has a characteristically dark-red crust. The favourite shapes of household bread, both in Germany and Austria, are either round or long, with more or less pointed ends. Sometimes the ends are rounded. This shape is very common in Dresden, the Schrotbrot being a wholemeal loaf. The round-shaped household loaf may be seen in the Vienna Schwarzbrot (Plate VIENNA BREAD—IV, Nos. 7 and 9). Such loaves will often weigh 3 kilos, or over 6½ lb.



FRENCH CRUSTY LOAF, SHOWING TEXTURE

FRENCH LOAVES AND ROLLS

DUTCH BREAD AND ROLLS

FRENCH AND DUTCH BREAD

CHAPTER XXXVII

CONTINENTAL COMMON BREAD: DUTCH BREAD

Though Holland is only a very small country, the bread-making processes are interesting enough to be dealt with in detail. Should an English baker visit a Dutch bakery he would be surprised to feel the springy, slack doughs made there. As a rule milk is used instead of water to make the dough because of the cheapness of milk. Generally the baker gets his milk by contract during the year at the price of $5\frac{3}{4}d.$ to $7d.$ the gallon. The quantity of yeast is also considerably larger than in the British sponges, even as long-system doughs are unknown tc the Dutch bakers. The proportion of yeast is not expressed, as in England, to the sack, but to the kilogram, which is equivalent to $2\frac{1}{5}$ lb. In some districts now the rate is 20 gm. ($\frac{7}{10}$ oz.) to the kilo, and in others even 25 gm. ($\frac{7}{8}$ oz.), or 5·6 lb. to 7 lb. per sack of flour of 280 lb. The quantity of salt used is also greater, and chiefly at the rate of 4·1 to 4·6 lb. per sack.

Dutch Method of Bread-making.

Quantities of Yeast and Salt.

The rule that flour takes half its own weight in water to make dough is neglected by the Dutch baker. For instance, the stiffest doughs contain even 60 per cent liquor, and there is really no limit for slackness, though 70 to 75 per cent may be taken as the general maximum. It seems rather strange to one who is used to the stiff English cottage dough to imagine dough of this slackness, and one is rather inclined to think of a paste. The method of making this kind of dough is peculiar to itself. Instead of wooden troughs, galvanized-iron ones are largely used all over the country. To make the dough a thin ferment containing all the liquor and two-thirds of the flour is set; this is allowed to stand some twenty or twenty-five minutes, and then the remainder of the flour and the powdered salt is worked in. When these are sufficiently mixed, the difficult task for the Dutch baker starts. To make the dough tough and springy it wants much working. Small pieces of about 10 to 12 lb. are pinched off the main lump by both hands, and beaten and stretched against the side of the trough. When one little bit is worked enough it is thrown into the corner of the trough, and the same operation is repeated on the remainder. In this way the dough is worked from one side to the other of the trough and back again several times, till the experienced baker thinks that the dough is worked enough. To prevent the dough from sticking to his hands, the baker dips his hands occasionally in a basin of water, to keep them wet all the time he is pinching and spreading the dough. The troughs are not dusted to prevent the dough from sticking, but are greased or oiled.

Method of Kneading.

As a rule Dutch doughs feel rather cold; the temperature of the liquor is seldom higher than 80°–85° F. Dutch bakers maintain that bread baked from dough which has been made from a liquor at a higher

temperature than 85° F. never has such a rich golden colour as that baked from dough of which the temperature of the liquor was 80°–85° F.

Low Temperature of Dough.

The handing up is done in a way similar to that followed in England. The moulding or rolling differs somewhat, as the main shape is oblong, but this, of course, is done as for English tin bread.

Bread laws never existed in Holland, and this enables the Dutch baker to scale his bread off at his own option. The price of a loaf scaled off at 1 lb. 10 oz. to 1 lb. 12 oz., made from so-called milk dough, is about $2\frac{1}{4}d.$ retail. The crust of Dutch bread is darker and more brownish than that of English bread, while also the texture is more open. When newly baked it is very moist and springy, but it becomes very dry when stale.

The photos illustrating this article will give a better idea of the shape and other noticeable qualities and faults.

The most popular Dutch loaf is the *Tin* or *Pan Loaf* (see Plate, Dutch Bread, No. 2), as a rule (in a large bakery) made from dough a little stiffer than that described above. After the loaves have been moulded 12 to 14 in. long, they are proved upside down on a cloth. The cloth is raised up between adjoining loaves to prevent them from sticking to one another. When proved sufficiently they are cut by an ingenious little machine, which has the appearance of a long row of pairs of small scissors, worked by two handles at each end. Every time after the machine has been used, the scissors are dipped in a small tank of oil, so as to prevent the dough from sticking to them, and to oil at the same time the different cuts of the loaf. This kind of loaf is called *Knip Brood* (see Plate, Dutch Bread, No. 4), which really means bread cut by scissors.

Knip Brood.

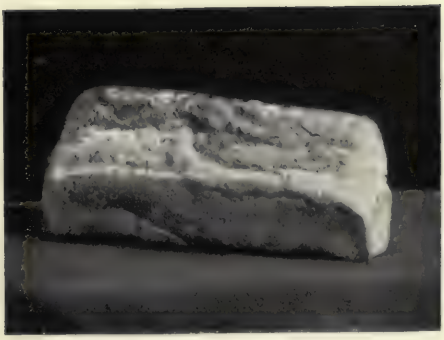
No. 6 on the Plate shows *German* or *Papped Bread.* The broken crust is obtained by brushing the tops of the loaves over with a peculiar kind of paste, consisting of flour, ground rice, yeast, foot sugar, and water. Under the influence of steam, either evolved by the bread itself, or introduced into the oven, this paste bursts or cracks, and gives the loaves their rather pretty appearance. This paste is made as follows. 1 lb. 6 oz. of flour is boiled with 10 pints of water till the paste thickens. This is thinned down by the addition of cold water when about to be used, so as to spread easily. A raw paste is then made with $10\frac{1}{2}$ pints water, about 9 oz. yeast, $6\frac{1}{2}$ lb. flour, $8\frac{1}{2}$ lb. ground rice, 4 oz. sugar, and about 3 oz. melted butter or sweet oil. This raw paste after fermenting a little is first spread on the tops of the loaves rather thickly, or at least well smeared over them with a brush. Some of the boiled paste is spread on top.

German or Papped Bread.

No. 3 on the Plate shows what is called *English Bread.* Why this strange name was given is a mystery, the shape not being at all like the chief shape of English bread. Such loaves are as a rule baked in couples, as shown in the Plate.

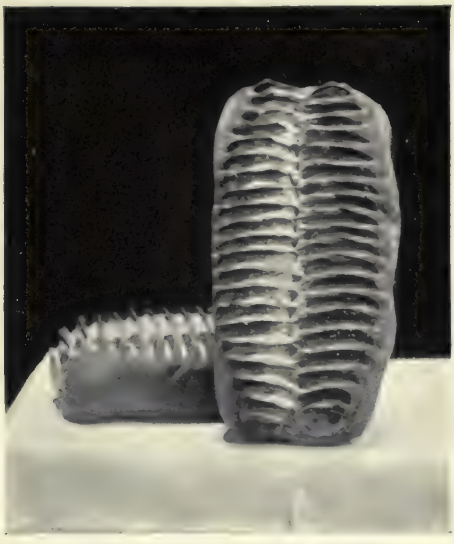
"English" Bread.

1. DUTCH RYE BREAD



2. PAN BREAD

3. "ENGLISH" BREAD



4. KNIP BROOD (SNIPPED BREAD)

5. DUTCH HOUSEHOLD BREAD

6. GERMAN OR PAPPED BREAD

TYPES OF DUTCH BREAD

Household Bread, illustrated in No. 5 on the Plate, differs somewhat from the former. The chief moistening agent is water instead of milk. These loaves are set in rows of eight or ten. The two outside ones are sold as crusty, and the inside as crumby loaves, at the price of 2*d.* per 2 lb. Dutch Household Bread.

The lowest illustration on the Plate of FRENCH AND DUTCH BREAD shows some that are merely a repetition of the other photos, but there is a couple we have not dealt with yet. On the extreme left and right sides are specimens of *Dutch Brown Tin Bread.* Brown bread is usually made of half white flour and half wholemeal. The left of the two centre loaves is called *Schootyes Bread.* It is shown clearly on the photo that the loaf consists of small pieces of dough, which, after having been moulded, are joined together. They are proved on long slips of wood, which are about the same length as the depth of the oven, and 3 in. in width. When they are proved enough, they are set in the oven in long rows lengthways. After baking, they look like long bread bars. For 1*d.* or 2*d.* a certain number of these pieces are purchased. The very light and soft breakfast rolls shown on the right of the photo are made from a dough consisting of the following ingredients: 22 lb. of flour, 6½ qt. of milk, 13 oz. of yeast, 5 oz. of salt, 9 oz. of butter, and 11 oz. of sugar. A ferment is made as described before; then after dough has been made, the butter is kneaded in. After sufficient proof, they are scaled off at 3½ oz. each, and moulded round like buns. When all moulded, the first lot is shaped in the following way. The hand is brought down smoothly on the dough with a sawing motion, thus nearly dividing it into two equal parts, only a small strip of dough keeping them together. They are proved on a cloth in rows of four, with the cloth raised up between each row. They have to be baked in a very hot oven. As a rule Dutch bread is baked at much higher temperatures than English bread, the oven in the case of the former being from 480° to 500° F. Schootyes Bread. Soft Rolls.

No. 1 on the Plate of DUTCH BREAD is a photo of *Rye Bread*, perhaps the most interesting one for the English baker. For its manufacture rye meal is exclusively used. 100 lb. of rye meal is mixed with 80 lb. of very hot water into a thick paste, the rye being almost scalded. Sometimes a small quantity—2 or 3 lb.—of treacle is added, but always from 2½–5 lb. of salt is mixed with it. When the paste is cooled down sufficiently the loaves are moulded and shaped in a square wooden frame, till they have the form and size, though not quite so thick, of an ordinary wall brick. To prevent sticking they are dusted with bran. The setting of this bread requires a good deal of experience, as no room has to be wasted. On top of the loaves wet boards are placed, and on top of these again a thick layer of wet offal is spread. Then the door is screwed to the mouth of the oven and the bread allowed to bake, or stew rather, in its own steam from twenty-four to forty-eight hours. The length of time allowed is determined by the amount of colour desired—whether it is wanted brown or black. The Dutch Rye Bread.

oven is, of course, becoming colder all the time the bread is baking, as the heat is not augmented in any way while the bread is in the oven.

Oven for Rye Bread.

The oven used for baking this bread is of the old "pot" type. A fire of peat, wood, and sawdust is made on the oven bottom, and when heated to the proper degree the fire is taken out; and, after a good cleaning, the bread is baked by the heat radiating from the bricks. There is no internal flue in this kind of oven, the draught being through the door opening only. In order to prevent the smoke from filling the bakehouse, a funnel-shaped screen, which projects the entire width of the oven, and has a depth of some 3 ft. at the bottom, is fixed over the door. On top of this funnel is the mouth of the flue, which is built on the top of the oven.

Dutch Fancy Bread.

As regards fancy bread, there is more variety in Holland than in Britain. It is called *pain de luxe*, and is in most cases a kind of fermented confectionery. Very often a Dutch baker proudly calls himself "Vienna, Dresdener, and Parisian baker". This indicates that he is able to make the different fancy rolls familiar in these cities; but there are some fancy breads peculiar to Holland.

Currant Bread.

For variety the Dutch families have, besides the ordinary white and brown bread and the famous rye bread, very often currant bread on the table. The well-to-do classes have a richer kind than the poorer. A very common currant bread, that is not much dearer than the ordinary white bread, is sold in great quantity. The dough for this consists of 100 parts of flour, 2 of yeast, 1·5 of salt, 65 of water, and 35 of currants. It is made in the same way as described above, only the currants are added last of all. The price of these loaves is 1 lb. 10 oz. for $2\frac{1}{2}d.$

The rich kind is different altogether. The dough for this consists of the following ingredients: 100 lb. of flour, 70 lb. of currants, 30 lb. of sultanas, 50 lb. of citron peel, 8 lb. of yeast, 75 eggs, 15 lb. of butter, 60 lb. of milk, 1 lb. of salt, and a few drops of citron oil. After a dough has been made of the flour, milk, eggs, salt, and yeast, and allowed to prove for some fifteen minutes, the butter is worked in first and then the fruit. It lies till proved sufficiently, and is then scaled off, handed up, and moulded in oblong loaves from 12 to 14 in. in length. These are proved on baking sheets, and washed over with egg, and cut like a baton with a knife before going in. The baker gets a fairly good price for this, averaging from 1 lb. 10 oz. for 8*d.*

Christmas Bread.

The Englishman now has his plum pudding, mince pies, &c., at Christmas. The Germans, and in our days to a great extent the Dutch people, have their *Weihnachtstolle* (see Plate, VIENNA FANCY BREAD—IV, Nos. 23, 26). The Dutchman sometimes gives them the same name, but he also speaks very often of *Kerstbrood*, which means the same thing. To make a good Weihnachtstolle requires much care and experience. As a rule it is difficult to obtain a good recipe for this bread. Many bakers, especially in Germany, make it their special one. Some bakers increase the quantity of butter, whilst others add some

ground bitter almonds. Make a dough of the following ingredients: 10 lb. of flour, 3½ pt. of milk, 8 to 10 eggs, 1½ oz. of salt, and 6½ oz. of yeast (a ferment should be made with all the liquor and one-third of the flour). When the dough has lain for some fifteen to twenty minutes, work in the butter (2¼ lb.), and last of all the fruit, 6 lb. of sultanas and 4 lb. of citron peel (sometimes a little citron oil is added). Care should be taken that the dough feels firm and springy when the butter is worked in. When proved sufficiently scale off to weight desired, hand up, and mould in the usual way. When moulded round, press the centre quite thin with a rolling-pin, so that the dough is nearly divided into two halves: then fold one half over the other. The loaf thus obtained will have the appearance shown on the plate. After baking dust them over with icing sugar. The best way to do this is to sieve the sugar over the loaves. The latter get then quite a snowy appearance. This kind of business pays the baker well. Weihnachtstolle weighing about 2 lb. are sold at 1*s.* 8*d.* to 2*s.*

A peculiar kind of rye bread, different from the English or Dutch rye bread, is very popular in Sweden. 15–20 lb. of water, at 105° F., 50 lb. of rye meal, 8 oz. of salt, 4 oz. of yeast, and a little caraway seed (if wanted) is made into a dough. When the dough has been made it is dusted with flour, wrapped up in a cloth, and covered with a woollen blanket, and allowed to prove from two to three hours in a warm place. If after that time the dough has shifted, it is kneaded again with some flour, and allowed to ferment some time again in the same way. After sufficient proof it is scaled off and moulded. The lumps of dough are—either with a rolling-pin or by hand—made into flat round cakes, from 12 to 14 in. in diameter and ⅛ in. in thickness. In the centre a hole of 2 in. in diameter is cut. These cakes are removed by special forks to a board and allowed to prove sufficiently. Then they are baked on the bottom of the oven, which has been previously heated by a wood fire. After the baking the cakes are brushed to remove the dust, and placed on sticks. To dry the cakes thoroughly, the sticks are suspended from the ceiling of a warm room for a couple of days. When baked they should have a light yellow-brown appearance. They are made to keep for any length of time when thoroughly dried. A better quality of this bread is made by taking milk instead of water, and by the addition of a small quantity of butter and white flour.

Swedish Rye Bread.

To make Dutch *Karlsbad Salt Sticks*, take 11 oz. of flour, 1 oz. of sugar, 4 oz. of butter, a pinch of salt, and ½ oz. of yeast, or an equivalent quantity of baking powder. Make with cold milk into a stiff dough. Then cut small pieces, roll them to the length and thickness of an ordinary lead-pencil. Wash them over with water, and sprinkle salt and ground caraway over them. Place them on tins, and bake them them off quickly at a steady temperature. After baking, soak them with melted butter.

Dutch Karlsbad Salt Sticks.

The following is the recipe for Dutch *Tea Sticks*: 9 oz. of butter

melted, 1 lb. 6 oz. of flour, 9 oz. of sugar, 5 eggs, 1½ oz. of carbonate of ammonia. Stir the melted butter, sugar, and eggs well together. Then add the flour gradually, and work this well in. Flavour with the zest of one lemon. Make from this dough short cut sticks, and bake lightly on tins. See Plate, VIENNA FANCY BREAD—III, Nos. 4, 5, 6.

Tea Sticks.

CHAPTER XXXVIII

YEAST FOODS AND STIMULANTS: BREAD-IMPROVERS

To bakers of less than fifty years ago, with vague ideas as to the nature, properties, and functions of yeast, the title of this chapter would have been but a meaningless phrase, yet they were daily using processes, the outcome of ages of practical experience, which resulted in the formation of materials admirably suited to the growth and reproduction of yeast. Such processes had been arrived at by purely empirical methods, and it remained for science to explain the reasons for their use, and to amplify the methods by indicating possible variations. To a native of Delft, by name Antony van Leeuwenhoek, belongs the honour of having discovered yeast to be a living organism. He died in 1723. It was not, however, until 1837 that three independent investigators, namely, Cagniard Latour, Th. Schwann, and F. Kützing, brought forward evidence to show that fermentation was a result of the life activity of yeast. It remained for Pasteur, in 1862, to dispose finally of the theory of spontaneous decomposition, and to establish the vitalistic theory of fermentation. The yeast cell having been admitted to the realm of living matter, its activities naturally became classifiable with the metabolic functions of all other living bodies. Its capabilities of growth, reproduction, and decay being once demonstrated, the problems of its nutrition, respiration, and excretions followed as a natural consequence. To these questions an army of workers have devoted themselves, and great advances have been made, yet much still remains to be done before the life history of a yeast plant can be authoritatively written.

Nature of Yeast discovered.

For the baker, unfortunately, much of the knowledge gained affords very little enlightenment respecting the important part played by yeast in the fermentation of dough. Narrowing the problem down to its simplest aspects, we may say that in a dough yeast performs two functions: it produces the gas necessary to bring about vesiculation of the bread during baking, and it also induces alterations in the chemical nature of the gluten of the flour, softening it, and in extreme cases destroying its original physical properties entirely. In order to discharge these functions efficiently, so that the effects are in perfect equilibrium—that is to say, sufficient gas production and just the right amount of gluten change being both effected in approximately the same

Functions of Yeast in Dough.

time—it is essential that the yeast shall be capable of living and growing vigorously, and not merely vegetating or sluggishly fermenting in a partially moribund state, conditions which can only result in low fermentations and sour, heavy, unpalatable bread. Yeast, then, in order that it may function normally, requires food; in other words, it must be supplied with material it can assimilate and utilize for building up its cell matter and reproducing itself.

It is of the first importance to ascertain how far the medium into which a yeast is sown is capable of supplying the requisite nutritive principles, and to what extent it should be supplemented by the addition of special materials which we shall designate *yeast foods*. Now, the principal needs of yeast, as of all living cells, are water, air, nitrogenous matters or proteins, carbonaceous matters, as sugars, &c., and salts. It is important to note that the nitrogenous matter is needed in several different forms, partly as true protein, and partly in certain combinations known to chemists as amides and amino acids. These latter bodies are of great importance, since they act as powerful accelerators of yeast activity. They are indeed similar in constitution and properties to the extractive principles obtained from meat extracts, and consequently are true physiological stimulants. Apart from water and air, all the nutritive principles will need to be present in flour if it is to suffice for yeast sustenance without the addition of special foods. **Essentials of Yeast Food.**

In olden times the baker did not need to buy a yeast food. He unconsciously made one every time he set a ferment or made a sponge. Sown into a nutritive medium, generally of flour with boiled potatoes, the yeast multiplies rapidly, the condition of ample liquid supply being especially favourable. Moreover, during growth and reproduction other secondary changes proceed in the medium, partly as an outcome of the yeast activity, and partly due to the bacteria which always accompany yeast. As a net result of these actions, the gluten in the medium becomes radically altered in constitution; it takes on very active properties towards other gluten, which it quickly softens, so that when a dough is made with a sponge or ferment it rapidly becomes sufficiently ripened for the oven. It is to the introduction of straight-doughing systems, in conjunction with the use of highly cleaned modern flours, that we must ascribe the very general demand for some form of yeast-accelerator as an adjunct in fermenting bread. The growing opinion in favour of a shorter working day also distinctly favours the adoption of anything which tends to hasten the process along. Yeast foods are sometimes used for sentimental reasons: bakers who have discarded potatoes think they must use something, although excellent bread can be made without any addition to flour except yeast, water, and salt. **Why Yeast Foods are used in Dough.**

A good yeast food fulfils two important requirements. By presenting readily fermentable matter to the yeast, it facilitates gas production, its function in this respect being that of a conservator of yeast effort; secondly, it may furnish material of a soluble nitro- **Function of Yeast Food.**

genous nature for the growth and reproduction of the yeast, and in this case it is truly a food. The materials commonly drawn upon to furnish yeast foods are comparatively few in number, they are very similar in character, and with one or two exceptions are quite inexpensive. The baker who is master of his craft should therefore have no difficulty in providing a yeast food suitable to his trade and mode of working from ordinary materials which may be bought in the open market. A very cursory glance at the list of substances given below will show that in all of the common yeast foods carbonaceous matter for conversion into alcohol and carbon dioxide is the chief constituent. Sugar, or some form of modified starch capable of ready transformation into sugar forms the basis. Thus we have: scalded flour, mashed potatoes, malt flour, malt extract, baked flour, cane sugar, glucose. In considering the nature of yeast foods, it is important to make a distinction between some of the many substances commonly classed under this heading. Moisture-retainers and flavourers are to be placed in quite a different category. They may or may not be yeast foods, but in any case they ought not to be confounded with true yeast foods, but should be considered as *bread-improvers*.

Common Yeast Foods.

When the composition of flour is critically considered, it may fairly be asked whether indeed there is real necessity for such substances as yeast foods. From a large number of analyses it is found that flour contains an average of 2 to 3 per cent of sugar, which is said to consist of maltose and cane sugar in about equal proportions. Now Dumas has shown that the amount of carbon dioxide required to raise an ordinary dough can be obtained from less than 1 lb. of sugar for each 100 lb. of flour. Again, the soluble proteins in flours vary between the limits of 1·5–2·5 per cent; that is to say, in 1 sack (280 lb.) of flour there is present from 4 to 7 lb. of soluble nitrogenous matter ready for absorption by the yeast plant. Apparently, then, there is sufficient to permit of a fivefold to sevenfold increase in yeast. Even should this quantity of protein become exhausted, there remains the gluten, which we know from experience is slowly converted into soluble forms during fermentation, and may in that condition become suitable for absorption by the yeast. The figures clearly show that the crude materials required for fermentation already exist in flour abundantly sufficient to satisfy the requirements of bread-making. Why, then, add more? The answer has been given above, viz., for greater speed of fermentation.

No Need for a Yeast Food.

Potatoes

Potatoes must be considered as the earliest yeast food. Where and when they were introduced no records now exist to show, but it is certain that until recent years potatoes were universally in use for this purpose throughout England. The mean composition of raw potatoes is given by König as follows:—

Composition of Potatoes.

	Water.	Proteins.	Fat.	Carbohydrates, chiefly Starch.	Cellulose.	Salts.
Mean of 239 analyses...	74·93	1·99	·15	20·86	·98	1·09

At first sight, then, it would seem that potatoes can hardly be considered of much use as yeast food, since they are so very poor in nitrogenous matters. The explanation of their efficacy must be sought in the qualitative nature of these nitrogenous constituents. According to Kellner, fully one-half of the total nitrogen is present as amides and other extractive bodies. E. Schultz found, among other bodies, peptone, xanthin, asparagin, leucin, and tyrosin in the non-albuminous, nitrogen compounds. Of these extractives asparagin at least has been proved to exercise a powerful stimulating effect upon enzyme activity; thus J. Effront found that upon adding ·05 gm. of asparagin to a starch solution containing diastase, a yield of 61·2 per cent of maltose was obtained in the same time as 8·63 per cent maltose was produced in a check experiment without this reagent. It will be noted that the activity of the enzyme is increased nearly eight times by the addition of only ·05 per cent of asparagin. It has been determined that potatoes contain about ·3 per cent of asparagin, so that in a one-sack dough, for which from 7–12 lb. of potatoes would be used, nearly ½ oz. of this stimulating agent would be present, and there appears to be good ground for the view that although the nitrogenous matter in potatoes is small in quantity, yet a very high proportion of it is present in forms which are especially useful to yeast.

Nature of Nitrogenous Matter in Potatoes.

When potatoes are boiled the starch grains do not become disintegrated, as in the case of cereal pastes, unless the boiling is unduly prolonged. This is to be attributed to the fact that the walls of the cells into which the starch grains are packed exert considerable pressure upon the contained starch, and thus prevent the individuals bursting. The consequence is that each starch grain, although greatly swollen and fissured, remains intact, the granulose or gelatinous part of the starch remaining still enclosed. In this condition starch is a very efficient water-retainer, without that stickiness which results with scalded flour. Further, the starch grains are sufficiently altered for diastasic enzymes to act upon them when present, and to convert them into sugars. This property of potato mash explains its undoubted value as a moisture-retainer and bread-improver in the physical sense.

Potato Starch.

On the other hand, it must not be forgotten that potatoes are very prone to certain diseases, and dangerous fermentative bacteria are frequently present on the skins. The presence of the ropy bread organism *Bacillus mesentericus* can frequently be demonstrated by washing the skins, especially around the eyes, with some sterilized water, and then inoculating sterile bread and cultivating for 12 hours in the incubator at 35° C. (95° F.).

Danger of Disease in Potatoes, and Rope in the Bread.

Potatoes are nearly always used in ferments, though a few bakers who have adopted straight-dough methods have transferred their old custom to the new process and continue to use *fruit*, as potatoes are called in the bakehouse. They are generally used in quantities of 7 to 12 lb. per sack, the washed potatoes being thoroughly boiled in about 1 gallon of water, and afterwards mashed to pulp and strained off the skins. The resulting mash is then seeded with yeast, with the addition of a small quantity of flour.

Scalded Flour

Scalded Flour as Yeast Food.

In various forms scalded flour has been largely used during recent years. It is perhaps the baker's sole attempt to manufacture a bread-improver, for, as will presently be shown, scalded flour has a low value as a yeast food. In composition it will closely resemble the cereal from which it is prepared, the chief alterations taking place as a result of scalding being the rupture of the starch grains and conversion of the material into a gelatinous paste, the rendering of the albumins insoluble by the heat of scalding, and the destruction by the same agency of any ferments which may have been present. As a true yeast food, therefore, scalded flour is distinctly lower in value than raw flour, since it is flour with its soluble proteins and ferments destroyed. On the other hand, the starch has been rendered soluble, and if any diastasic ferments are introduced with the yeast, doubtless maltose will be formed, and this material then becomes a good basis for gas formation.

Experiments on Scalded Flour.

From a large number of experiments conducted at the National Bakery School, London, it would appear that the effects of scalded flour in bread are physical rather than chemical, and for this reason it must be regarded primarily as a bread-improver, and to a very small extent as a yeast food. These experiments showed that only a very slight change of the gelatinized flour into glucose could be detected, whilst the characters of the bread produced were such as might be expected when a difficultly drying gelatinous material is added. Thus in proportions up to 3 lb. per sack beneficial results were noted. The colour of crust was better, the crumb was whiter, and the retention of moisture was markedly improved. The volume, however, instead of being greater, as might certainly be expected if gas evolution resulted in increased amount, was indeed entirely in the opposite direction of closeness. This effect is accentuated with increasing quantities of the scalded flour, so that when 10 lb. per sack is used the bread becomes soggy and impossible to bake thoroughly. Bread containing such large quantities as this has a marked raw, starchy flavour, even when quite dry, and this lends additional support to the views expressed above.

Cane Sugar and Glucose

Cane sugar and glucose are two substances very frequently employed, mainly perhaps because it is popularly thought that the chief function of a

yeast food is to yield gas. As we have already shown, this is an incorrect view, and these substances being practically devoid of nitrogenous constituents are not yeast foods at all. The following analyses of these substances will show the chief differences in composition between them:— Cane Sugar and Glucose.

	Water.	Cane Sugar (Sucrose).	Glucose and Maltose.	Dextrin.	Ash.	Remarks.
Cane Sugar—						
Centrifugal, good ...	1·5	96·5	0·75	—	0·40	
Beet, first quality ...	2·0	95·0	0·00	—	1·25	
Refined, granulated...	0·0	99·8	0·20	—	0·00	
Refined, yellow ...	6·0	82·0	7·50	—	2·00	
Glucose	16·27	—	68·25	14·91	0·57	Mean of 52 analyses.
	18·47	—	44·86	35·55	0·99	Mean of 59 analyses, American.
	14·38	—	49·38	35·16	0·14	Dry chips.

Refined cane sugar is probably the purest chemical substance met with in commerce, the solid matter consisting as it does of 99 per cent sucrose. It contains practically no nitrogen, and consequently is neither a true food nor a stimulant. It is, in fact, a gas-producer pure and simple. Cane sugar is a disaccharide, and is not directly fermentable by yeast. It must first be changed into a monosaccharide, and this change is accomplished by yeast through the agency of its enzyme, invertase. When working with cane sugar, not more than 2 lb. per sack are necessary, this quantity being more than sufficient to yield all the gas required, and at the same time still leave a residue which will give the bread a sweet flavour and a rich bloom. It is, in fact, for the purpose of giving the bread this bloom that sugar is generally used.

Glucose is a monosaccharide, and consequently is directly fermentable by yeast. It is usually obtained from starch by the action of an acid and the subsequent purification and concentration of the resulting syrup. In addition to the substances shown in the analysis there are usually small quantities of undetermined bodies which result from the action of the acid, and sometimes give a slightly unpleasant flavour. Like cane sugar it contains no nitrogenous matter, and cannot assist yeast multiplication; it is, however, quite the best gas-producer which can be used, since the yeast can begin to act upon it the moment contact is made. It thus affords a valuable aid where extremely short systems are desired with corresponding good bulk. Glucose comes into market in two forms, as solid chips or in thick syrup. On account of the larger percentage of moisture and its very much lower sweetening power, it can be used in doughs in slightly larger proportion than cane sugar, but the limits should generally be about 2 lb. per sack. In addition to its gas-producing properties, glucose may also act as a bread-improver.

Both cane sugar and glucose may have seriously detrimental effects if the dough is allowed to become overfermented. The bread will then be dry and crumbly to an extraordinary extent. A remarkable fact in this connection is the peculiar action of glucose and cane sugar upon gluten. It has been found by J. Kirkland that when large quantities are used in dough the tenacity of the gluten is completely destroyed, so that in a very little time it becomes impossible to separate any gluten by the ordinary method of washing out. The reason for this action is not at present clear, but it is evident that considerable danger is entailed by the use of excessive quantities of these sugars.

Effects of Excessive Sugar on Gluten.

Rye Flour

Rye flour has long been considered a very efficient quickener of fermentation, and this is attributed to the relatively large amount and the nature of the soluble proteids in rye flour. Very little has been done to test the correctness of this view, and it should be borne in mind when considering the question, that rye is never so finely milled and separated as wheat is. The product in consequence is darker in colour, and it is also quite fair to assume that the activity of rye flour is largely due to the aleurone constituents of the rye bran, which would be separated if rye went through the ordinary separations practised in wheat-milling. The peculiar effect of newly milled wheat flour from stone mills was very similar in kind, but incomparably less in intensity, to that noted in the use of rye flour, and it is reasonable to attribute both effects to the same agency. The following analyses of rye and wheat flours will serve to show the important differences between them, part of which may be due to mode of milling:—

Rye Flour and its Action.

Composition of Rye and Wheat Flour compared.

	Water.	Nitrogenous Matters.		Fat.	Carbohydrates (Sugar and Starch).	Cellulose.	Salts.
		Soluble.	Insoluble.				
Rye flour	13·85	3·33	9·11	2·17	66·21	3·93	1·40
Wheat flour							
(*a*) fine	15·54	1·34	9·82	1·07	71·27	0·32	0·60
(*b*) coarse	14·25	1·45	12·39	1·25	68·27	0·99	1·40

It will be noted that rye contains rather more than double the proportion of soluble nitrogenous matter present even in coarse wheaten flour. Rye flour can be used safely in quantities up to 3 lb. per sack, the latter only if flour is very strong. The best method of preparation consists in mixing the flour into a moderately thick paste with water at 165° F., and allowing the mixture to stand for three to four hours. The object of using water at 165° F. is to utilize any diastasic properties to the fullest advantage, for at this temperature starch transformation takes place very rapidly.

Higher temperatures will destroy the enzymes. In a series of experiments with rye flour it was found that the gas yield was more than doubled compared with a wheaten flour test carried on for the same time. The proteins of rye have a degrading action on the gluten of wheat flour, and in excessive quantity make the dough runny and the bread flat.

Germ and Malt Culms

Germ and malt culms are less known and more seldom used as yeast foods, although both these materials contain relatively large amounts of chemical compounds favourable to the growth and multiplication of yeast. The following partial analyses of germ and culms will give an idea of the general composition of these bodies:— Germ and Malt Culms.

	Water.	Nitrogenous Matters.		Fat.	Carbohydrates.		Cellulose.	Salts.
		Soluble.	Insoluble.		Gums and Sugars.	Starch, &c.		
Germ	8·7	6·6	26·5	15·0	23·0	10·0	1·7	5·4
	11·5	10·5	12·6	12·0	9·7	30·5	5·9	3·9
Culms	14·1	12·08		3·46	11·9	—	15·2	9·63
	8·5	15·89		1·85	13·4	—	12·5	12·6
	7·5	14·9		2·51	—	—	—	4·5

It was at one time thought that germ was rich in diastasic properties, but further investigations do not support this view.[1] The enzymes of germ are incapable of transforming the starch which is present in the germ. The diastasic properties are very low, and the yeast-stimulating effects of the material are not due to its powers of starch-conversion, but to the soluble nitrogenous constituents, in which it is very rich. We have already alluded to the amides, *e.g.* asparagin, leucin, &c., and it is these bodies which constitute a considerable proportion of the nitrogen content of germ, supplemented by albumoses and plant peptone. It has recently been shown by Dr. H. Brown that these bodies are of vital importance to yeast growth, for, with their exhaustion from a medium, the activity of yeast gradually declines, ultimately ceasing, even though there may still be considerable amounts of soluble nitrogen left in solution and a large amount of sugar unfermented. From the analyses it may be concluded that there is no necessity to consider diastasic activity as indispensable, for it will be seen that germ contains from 10 to 20 per cent of ready-formed sugars, or nearly 7 oz. in 3 lb. of germ upon the average. The effects of germ are certainly best explained by the theory that they increase yeast. The results of a series of interesting experiments bearing upon this point, published by J. Kirkland, are reproduced here. Roughly, it will be seen that gas production was increased proportionally to the quantity of germ added. In these tests, ferments containing 4 oz. flour and ½ oz. yeast in 400 c.cm. of

[1] This is still a matter in dispute, and some recent experiments clearly show that fresh germ does exercise considerable diastasic activity.

water at 90° F. were kept in a warm-water bath, and the gas evolved was measured at regular intervals. The figures obtained were as follows:—

	20 min.	45 min.	2 hr. 45 min.	3 hr. 45 min.
	cu. in.	cu. in.	cu. in.	cu. in.
I. Ferment + ½ oz. germ	9·1	26·0	56·0	57·5
II. „ + ¾ „	14·0	30·4	63·4	75·9
III. „ + 1 „	13·0	32·0	63·3	74·3
IV. „ + 1¼ „	14·2	36·0	70·2	82·2
V. „ + 1½ „	14·2	37·0	70·4	82·2
VI. „ + 2½ „	19·0	45·0	80·2	95·2

Germ may be used in quantities up to 2 lb. per sack with perfect safety. The best method of use for white bread is to make a decoction by steeping the desired quantity of germ in water at about 160° F. for an hour, and then straining the liquor off through muslin. In white bread it is better not to use the solid germ, on account of the yellow colour of the particles; yet if the germ itself is clean and mixed, not in the flour, but in the water, it is very difficult to see any yellow spots in the resulting bread. The liquor, however, will impart no colour to the resulting bread, unless used in very excessive quantities.

Method of using Germ.

Culms, or malt coombings, are the broken rootlets from malt. They are similar in all respects to germ as regards their yeast-stimulating properties. They are already used considerably as yeast food in the industries of brewing and yeast-making. Culms may be used up to 2 lb. per sack, and should be introduced in exactly the same manner as germ. Both these substances are to be recommended in preference to potatoes. Germ and malt culm extracts contain all the stimulating properties of potatoes minus the dangerous bacteria. In the bread, also, germ and culms are natural flavour-producers, imparting richness and nutty taste.

Malt Culms.

CHAPTER XXXIX

BREAD-IMPROVERS

Malt Flour and Malt Extract

Perhaps the most widely used yeast foods and bread-improvers at the present time are the various forms of malt flour and malt extract; yet there are few substances liable to wider variations in composition and value or which present such great difficulties in detecting those differences. For the non-technical man there exist no tests by which good samples may be sorted out from poor ones.

Malt Flour and Malt Extract.

Malt may be obtained by artificial germination of any cereal. For several reasons, however, barley is the one generally employed. The grain,

after cleaning, is first steeped in several changes of water, and then spread out in thin layers upon floors and allowed to sprout. The process occupies about eight days, during which time the mass is frequently turned to prevent local heating, &c. When sufficiently grown the "piece", as the floor of grain is called, is transferred to the kiln, a kind of oven where it is slowly dried, and finally raised to a temperature sufficient to cure it and produce the required flavour. The following analyses of barley and malts will show the changes brought about by the process of malting. The analyses of the malt are by O'Sullivan.

Preparation of Malt.

Malt and Barley Compared.

	Water.	Nitrogenous Matters.		Carbohydrates.		Cellulose.	Fat.	Salts.
		Soluble in Cold or Warm Water.	Insoluble Cold and at 70° C.	Sugars.	Starch.			
Barley ...	13·88	1·7	12·4	4·13	55·57	7·76	2·66	2·3
Malt, No. 1	5·8	6·71	6·38	21·23	44·15	11·57	1·65	2·6
„ No. 2	7·4	5·31	8·49	19·39	45·13	10·09	1·96	1·92

As a consequence of the growing process malt contains, when properly made, large quantities of the active bodies called enzymes. The following are known to be present: diastase, maltase, invertase, peptase, and cytase(?). In addition to these powerful chemical agents it also contains large amounts of soluble carbohydrates formed from the starch of the endosperm. The most important property of malt products is the content of active agents, but these delicate substances are exposed to many risks at every stage of the process of preparation, and it may often happen that an extract or flour will be quite devoid of diastasic or proteolytic activity. In malt flours age is perhaps the greatest danger. When ground, malt absorbs moisture with great avidity, and the enzymes are quickly weakened, and destroyed when the malt becomes at all slack. Similarly, too great heat in kilning, extracting, or in the final evaporation of a malt extract, will have the same effect, and the resulting extract will be little better than a concentrated syrup. On reference to the analyses of O'Sullivan it will be seen that quite large amounts of fermentable sugar exist in malt, and by careful extraction this may be largely increased if the temperature is properly regulated. If the temperature is carried to the extreme diastasic limit, the whole of the starch in the malt will be changed into sugar, and will thus become capable of extraction, but this result will be obtained at the expense of the diastase, which in all probability will be entirely lost.

Dr. H. Brown has recently shown that the soluble proteins of malt consist of albumoses, peptones, and amino acids to the extent of 60 per cent of the total soluble nitrogen present. It is important to remember that in low-temperature extractions the active enzymes increase the soluble nitrogenous matters. It will also be seen how

Composition of Malt Proteins.

important it is that during concentration the temperature is not raised too high, else the soluble proteins are coagulated and thrown out of solution. Malt extracts are generally used in comparatively small amounts, insufficient to have any pronounced effect in either direction. Except on the ground of cost there is no reason why quantities up to 5 or 6 lb. per sack should not be used, in which case distinctive results would be obtained. In excessive quantity—10 lb. or more—malt extract acts similarly to other sugars; the bread becomes short and crumbly, and the colour is adversely affected. The use of malt extracts is largely due to the attempt to provide the subtle flavour supposed to have been lost through the exclusion of germ and bran cerealin from modern roller-milled flours. The following analyses will give an idea of the composition of some commercial malt extracts:—

Composition of Malt Extracts.

Sample.	Specific Gravity.	Total Extract.	Acidity.	Nitrogenous Matters.	Maltose.	Dextrin.	Ash.	Time Taken to Transform Equal Weight Starch.
A	1·38	72·3	·26	3·32	62·5	5·2	1·21	5 min.
B	1·42	76·6	·29	3·11	65·4	6·9	1·19	10 „
C	1·49	79·8	·43	4·87	61·32	12·3	1·23	5 „

The diastasic property is the most important principle of a malt extract, and a good sample should be capable of converting an equal weight of starch in ten minutes at 55° C. (131° F.). During fermentation of a dough there is probably very little starch conversion, even with the most actively diastasic extract, unless there is gelatinized starch of some kind present also, in which case sugar will be formed and gas evolution will be accelerated. When only the raw starch of the flour is present, practically no change can take place until the bread is in the oven. Here, as the interior of the loaf will rise very slowly to 212° F., there will be time for some starch change to take place whilst the temperature ranges from 140° to 180° F., and considerable sugar may then be formed. These sugars will remain in the bread, forming flavour and moisture retainers, since it will be impossible for yeast to attack the sugar, as it is killed at temperatures below that of starch transformation, viz. about 125° F. It is as a bread-improver, therefore, that malt extract needs to have a good diastasic power.

A ready method of evaluating the diastasic power of a malt extract consists in treating ·5 gm. of dry starch with hot water and bringing to the boil; then make up to 100 c.c. Dissolve 5 gm. of the sample extract in 100 c.c. of water. Take 20 c.c. of starch solution and cool to 60° C. (140° F.); then add 1 c.c. of the malt extract solution, and place in a water bath at 60° C. (140° F.). At intervals of 15 minutes remove one drop of the solution with a glass rod and place on a tile; then add one drop of solution of iodine in potassium iodide.

Test for Malt Extract.

Continue until the iodine solution, instead of giving a deep-blue, yields only a pale-yellow colour. Add fresh quantities of 1 c.c. malt extract each half-hour until this result is obtained. If the malt extract is good it will not require more than 2 c.c. to obtain this result.

Milk

Milk is used to some extent in bread-making, and it may be properly regarded as a bread-improver. There are now upon the market many brands of dried milk, and as this material can be very conveniently stored without risk of deterioration, it is generally preferable to purchasing the liquid. Much of this dried milk, however, has more or less of the original fat removed, and in some cases may be little more than a mixture of casein and lactose. It is better, therefore, to obtain a guarantee of the fat content when purchasing.

Milk as Yeast Food.

Milk sugar (lactose) is commonly said to be non-fermentable by yeast, but certain yeasts (kephir) are now known which can split this sugar into dextrose and galactose by means of a special enzyme, after which fermentation takes place in the usual way. But experiments have shown that the compressed yeast used by bakers has practically no effect on milk sugar. Generally lactose becomes fermented to lactic acid, as is expressed in the following equation:—

Milk Sugar.

$$\underset{\text{Lactose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Water.}}{H_2O} = \underset{\text{Lactic acid.}}{4C_3H_6O_3}$$

This change is brought about by many species of bacteria. The flavour, colour, and texture of bread are very materially improved by the use of milk, and doubtless the soluble albumins also furnish some food for yeast growth. It should not be used in excessive quantities, because of the binding effects of large quantities of casein. The best mode of using is to dilute the milk with an equal bulk of water. Fermentations of milk bread should not be too prolonged, else the multiplication of lactic germs may proceed so far as to cause destruction of gluten, and consequent crumbliness in the bread.

There is little doubt that the fat introduced with milk contributes largely to the silkiness and texture of the bread; hence care should be exercised when using dried milks to ensure getting a material which has not been entirely deprived of its fat. A genuine dried unseparated milk should have approximately the following composition:—

Composition of Dried Milk.

	Per Cent.
Moisture	4·5 to 7·16
Fat	28·7 „ 22·45
Proteids	25·3 „ 26·83
Carbohydrates	36·18 „ 36·31
Ash	5·24 „ 6·93

Such a powder, upon reconstitution with warm water in the proportion

of 1 part by weight to 8 parts of water, will yield a fluid exactly similar in composition to ordinary cows' milk.

CHAPTER XL

CHEMICAL AERATING AGENTS: SODA, PEARLASH, ETC.

First Aerating Agents.

In order to raise bread or other goods, a gas must be liberated within the mass, which, by its expansion under the rising temperature of the oven, can form a multitude of cavities throughout the material, keeping the layers apart until such time as the gluten sets into a tenacious film. The earliest aerating agent was undoubtedly yeast in the form of leaven, and later, when its properties became known, brewers' yeast, or that prepared by the baker in his barms. With the advancement of chemical knowledge it became evident that other methods of obtaining this gas could be employed without resorting to the process of fermentation. Such processes yield unfermented or chemical bread, and among the objects of the originators of these methods may be mentioned the saving of time effected and the prevention of that loss of solid matter, variously estimated at from 1 to 3 per cent, which results from the fermentation of sugar by yeast. It has also been claimed that the addition of certain of these saline substances to bread replaces the reduced salts in white flour brought about by the removal of the bran. The best example of such a substance is the *Horsford-Liebig Powder*, well known in Germany, and one of the earliest of baking powders. This consists of a mixture of acid calcium phosphate and sodium bicarbonate.

Liebig Powder.

On the other hand, it is well to remember that with the majority of these artificial aerators there is a considerable residue of chemicals left in the goods which is of a more or less potent medicinal character, whilst the chemical agents used do not exercise those softening effects upon the gluten which occur during yeast fermentation, and, in consequence, bread made by such processes is apt to be flat and raw-tasting. In the case of fancy goods, *e.g.* scones, cakes, &c., this failing is not so noticeable on account of the sweetening and flavouring materials present in predominating quantities. For this reason, and also because in some mixtures, where large quantities of sugar, milk, and eggs are being used, it is difficult, and sometimes impossible, to get yeast to work, the artificial aerating materials find more favour with confectioners than with bread-bakers. One product of the bread baker has, however, been frequently made by artificial agents, viz., brown bread. The idea was, that on account of the bran principles which are included in wholemeal flour, the doughs made with them will not stand any lengthy yeast fermentation without great alteration of gluten, and there is great danger of insufficient gas formation unless the

dough is allowed to become badly over-ripe. This was only true, however, with slow-working barms and long processes; and the difficulty is easily overcome with a quick-working yeast. In order to avoid this trouble in the past, artificial raising was largely practised, and even now it is sometimes resorted to. Of course in such cases the flavour of the bran masks any defect in ripening flavour. Certain proprietors of wholemeal breads adopt this method in part by adding small quantities of baking powder to act as aids to the yeast.

It seems highly probable that the earliest applications of artificial aeration were due to accident rather than design, for it is in such foods as gingerbread, honey cake, &c., where yeast is inapplicable, that their use would appear to have originated. **Gas produced by Aerating Agents.** The only gas which has been successfully applied to this purpose is carbon dioxide, which, curiously enough, is the gas naturally produced by yeast. Two properties make this gas particularly suitable for the purpose, the first being its great solubility in water, and the second the harmless nature of the substances from which it can be prepared. No other gas could be obtained from solid materials without leaving behind powerful chemical salts, which would in most cases be highly poisonous. Almost the sole source of the carbon dioxide (CO_2) used in the bakery is sodium bicarbonate ($NaHCO_3$), though potassium carbonate (K_2CO_3) is used to a small extent. The acid used for liberating the gas, however, varies greatly, and it is to the variation in the acid constituents that the different baking powders owe their origin.

Sodium Bicarbonate, or *Saleratus* ($NaHCO_3$), was formerly obtained by passing carbon dioxide gas into solutions of normal sodium carbonate. **Sources of Sodium Bicarbonate and Pearlash.** The reaction which took place is represented by the equation—

$$\underset{\text{Sodium carbonate.}}{Na_2CO_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon dioxide.}}{CO_2} = \underset{\text{Sodium bicarbonate.}}{2NaHCO_3}$$

The bulk of it is now, however, made by the *Solvay process*, which consists essentially in passing carbon dioxide gas under pressure into a brine solution saturated with ammonia gas. The change is given below—

$$\underset{\substack{\text{Sodium}\\\text{chloride (salt).}}}{NaCl} + \underset{\substack{\text{Ammonium}\\\text{hydrate.}}}{NH_4HO} + \underset{\substack{\text{Carbon}\\\text{dioxide.}}}{CO_2} = \underset{\substack{\text{Ammonium}\\\text{chloride.}}}{NHCl} + \underset{\substack{\text{Sodium}\\\text{bicarbonate.}}}{NaHCO_3}$$

Potassium Carbonate, Potashes, or *Pearlash* (K_2CO_3), was originally obtained by calcining wood and plant refuse. The ash was extracted by water, and the salts obtained by evaporation of the liquid-formed *potashes*. Potashes is generally slightly impure, and is purified by treatment with water and recrystallization, the product then being known as *pearlash*. Potassium carbonate is also obtained from beetroot residues obtained from the manufacture of beet sugar. Large amounts are now also obtained from the Stassfurt deposits in Germany.

Result of heating Sodium Bicarbonate.

When sodium bicarbonate, either alone or in solution, is heated above 100° C. (212° F.) it yields one-half its carbon dioxide and becomes converted into normal sodium carbonate. Thus—

(*a*) $\underset{\text{Sodium bicarbonate.}}{2NaHCO_3} = \underset{\text{Sodium carbonate.}}{Na_2CO_3} + \underset{\text{Carbonic acid.}}{H_2CO_3}$

(*b*) $\underset{\text{Carbonic acid.}}{H_2CO_3} = \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon dioxide.}}{CO_2}$

The carbonic acid which results from the first change cannot exist in the free state, and therefore it breaks up, producing carbon dioxide and water. In studying the foregoing reaction, it should be noted that we start with an acid salt, and the result of heating it is to dissociate it into a normal salt and the excess acid, the latter being then resolved into carbon dioxide and water. The character of the residue also requires consideration. Sodium carbonate is common soda, similar to that used for washing purposes, and has a strongly alkaline reaction. Its effect upon flour and saccharine materials is to impart a strongly marked yellow colour, and it also gives the goods the strongly caustic taste familiarly associated with the name of soda. On account of these unpleasant results sodium bicarbonate is never used alone, though owing to the use of improper proportions in making baking powders excess of the bicarbonate is often present, which immediately becomes apparent in the goods. The household method of making soda scones by means of sour milk, or buttermilk and saleratus, is a close approach to the use of soda alone. In the process of butter-making the milk is soured by the action of bacteria present, with the production of small amounts of lactic acid. This acid rarely amounts to more than ·5 per cent, and even in very sour milk will not reach more than 1 per cent. Unfortunately, such small quantities of acid are quite insufficient to neutralize more than a fraction of the bicarbonate which must be used if proper aeration is to be attained, and the unchanged bicarbonate, on heating in the oven, undergoes the change already described, leaving alkaline sodium carbonate as a residue in the scone. The reaction between lactic acid and sodium bicarbonate may be written thus—

Effects of Washing Soda on Flour.

Sour Milk and Soda.

$$\underset{\text{Lactic acid.}}{HC_3H_5O_3} + \underset{\text{Sodium bicarbonate.}}{NaHCO_3} = \underset{\text{Sodium lactate.}}{NaC_3H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon dioxide.}}{CO_2}$$

Sodium bicarbonate requires rather more than its own weight of lactic acid to neutralize it. It would, therefore, be quite impossible to use sufficient sour milk to neutralize the bicarbonate required for scone-making.

It is well known that in mixings containing large quantities of sugar, syrup, honey, or treacle, the yeast plant cannot thrive and ferment properly; consequently such articles cannot be raised by the fermentative process. It was long ago discovered, however, that if pearlash was added to the treacle or other syrup material before putting into the flour, the doughs so made, after keeping for a time,

Use of Pearlash in Gingerbread, &c.

which may vary from two days to nearly twelve months, would be partly aerated, and turn out good gingerbreads or honey cakes as the case might be. This is the basis of the Dutch and German methods of honey-cake making, and also that of gingerbread production in this country. It was considered necessary at one time to add also small quantities of alum, which, as we shall see later, is an acid substance capable of liberating carbon dioxide from potashes, but probably the great value of this salt lay in its hardening action upon the gluten, thus preventing too great a softening.

Alum and Pearlash used.

In this country sodium bicarbonate is still used alone in making gingerbread, pearlash being discarded. The chief agent bringing about the liberation of gas is to be found in the syrups, which are usually slightly acid at the time dough is made. This acid slowly increases during the time of lying, chiefly owing to the increase of certain bacteria. The reaction bringing about gas evolution is very slow, partly because of the high viscosity of the medium and partly owing to the very small amounts of acid actually present. It is not possible to give an equation for the reaction taking place, because the exact nature of the acids present has not been fully investigated. The addition of rapid gas-producers like tartaric acid would not be of any use in such mixings as the above, because the carbonate would be exhausted long before the material was required for the oven.

Why Gingerbread Aerates when Dough is kept.

The idea of producing carbon dioxide by means of a chemical reaction, so as to leave only neutral salts in the product, was first patented by Dr. Whiting in 1837.[1] The materials he used were sodium bicarbonate and hydrochloric acid in the proportions required to combine exactly with one another. The reaction is expressed as follows:

Salt produced by Chemicals.

Residue left in goods.

$NaHCO_3$	+	HCl	=	$NaCl$	+	H_2O	+	CO_2
Sodium bicarbonate.		Hydrochloric acid.		Sodium chloride.		Water.		Carbon dioxide.

The great advantage of this method lies in the fact that only common salt (NaCl) remains as a residue when the right quantities are used. Care needs to be exercised to ensure that minimum quantities of the reagents are used to obtain the desired leavening effects. Perhaps the chief difficulty in the use of Whiting's method is to be found in the liquid form of one of the reagents and the consequent liability to variation in strength. The best method of overcoming this is to check the neutralizing power of the acid upon a sample of the bicarbonate. This may be done by weighing out about 10 gm. of the bicarbonate and dissolving in distilled water in a beaker. Bring to the boil, and add a few drops of litmus solution. Fill a burette with the acid, and then run slowly into the hot soda solution until the colour just changes to red. Read off on the burette the number of c.c. of acid used, and this will give approximately the volume of acid required to neutralize a given weight of sodium bicarbonate.

Testing Strength of Acid.

[1] In a work published in Glasgow by a baker in 1832 reference is made to the use of soda and magnesium carbonates, and the same author also refers to the use of soda and hydrochloric acid.

In applying this method in practice it is necessary to mix the bicarbonate of soda well into the flour. Add the requisite amount of acid to the water for dough-making, and then make dough in the usual way. The quantities of reagent to be used should be based upon the amount of sodium bicarbonate required for ordinary baking powders, and the necessary acid adjusted to suit; about 10 oz. of sodium bicarbonate should be sufficient for 1 cwt. flour. The chief danger attending the use of hydrochloric acid is the possibility of contamination with arsenic. It must be guarded against by purchasing the purest acid under guarantee of freedom from this poisonous element. These substances were once extensively used in making wholemeal bread, but are hardly ever employed now.

CHAPTER XLI

CHEMICAL AERATING AGENTS: BAKING POWDERS, ETC.

Tartrate Powders

An important advance was made in artificial aeration by the substitution of solid acid substances for the liquid hydrochloric acid, for this enabled mixtures of aerating materials to be made with the flour for long periods in advance of requirements, thus securing a great economy of labour. Self-raising flour then became a marketable commodity. Another advantage is that water only is needed to bring about gas production. The typical acid used for this purpose is *tartaric acid* ($H_2C_4H_4O_6$). It is prepared from *argol*, a crude deposit of potassium hydrogen tartrate, obtained as lees from the casks used in wine-making. The reddish-coloured deposit is boiled with water to purify it, and the solution afterwards crystallized. A fresh solution of the crystals is then made and treated with chalk, so that insoluble calcium tartrate is formed. The deposit is collected and treated with the exact quantity of sulphuric acid required to liberate the tartaric acid, the calcium sulphate thus formed is separated off, and the tartaric acid solution is then allowed to crystallize. Tartaric acid crystals may be reduced to powder and mixed with sodium bicarbonate, no reaction taking place between them so long as moisture is absent. In order to minimize the danger of moisture attacking the powder, all commercial baking powders are diluted with a proportion of air-dried starch, which acts as a drying agent. The quantity of starch used for this purpose is very variable, but generally ranges between 23 and 50 per cent of the total mixture. In some few powders lactose or milk sugar is used instead of starch. When tartaric acid is used, the reaction results in the production of neutral sodium tartrate in accordance with the following equation:—

Tartaric Acid and Soda.

$H_2C_4H_4O_6$	+	$2\,NaHCO_3$	=	$Na_2C_4H_4O_6$	+	$2\,H_2O$	+	$2\,CO_2$
Tartaric acid.		Sodium bicarbonate.		Residue left in goods. Sodium tartrate.		Water.		Carbon dioxide.

The practical drawback to the use of this agent is that the evolution of gas is too rapid, and the reaction is spent before the goods are ready for the oven. This results in considerable loss of carbon dioxide in moulding, &c., and there is no reserve for gas evolution during baking, so that there is danger of insufficient bulk in the finished articles. This difficulty is overcome by the substitution of *Potassium Hydrogen Tartrate* (*Cream of Tartar*) for the free acid. This salt is the original form in which tartaric acid occurs in the wine lees, and it is obtained by simple solution and recrystallization. For preparation as a baking powder, cream of tartar is powdered and mixed with sodium bicarbonate and starch in the usual manner. When treated with water, however, owing to the lesser solubility of the acid salt, it does not quickly enter into action with the soda, but when the goods are brought into the oven, the increasing temperature facilitating solution of the acid salt causes a rapid evolution of gas just at the time it is most necessary. The reaction is expressed thus:— **Soda and Cream of Tartar.**

				Residue left in goods.				
$KHC_4H_4O_6$	+	$NaHCO_3$	=	$KNaC_4H_4O_6$	+	H_2O	+	CO_2
Potassium hydrogen tartrate.		Sodium bicarbonate.		Potassium sodium tartrate.		Water.		Carbon dioxide.

The residual salt, potassium sodium tartrate, is known commercially as *Rochelle salts.*

Both the residues left when tartaric acid is used have somewhat marked purgative properties, and care should be taken not to use them in excess. Another danger attending the use of tartrate powders arises from the liability of the tartrates to contain lead. The lead is dissolved by the acids from the vessels used in the process of manufacture; and though only present in very small quantities, yet, in view of the serious cumulative effects of small amounts of lead, it is very desirable to avoid introducing such dangerous poisons into foodstuffs. From the large number of prosecutions lately occurring under the Food and Drugs Act, it appears to be very common for traces of this metal to be present in baking powders which contain tartaric acid, and it is therefore necessary to obtain a written warranty of freedom from lead when purchasing tartrate powders. A good cream-of-tartar powder will yield about 13 per cent of gas. The common impurities and adulterants of cream of tartar are gypsum (calcium sulphate), calcium phosphate, bone meal, &c. These impurities, being insoluble, will be found mixed in the starch after treatment of the powder with hot water. They may then be recognized microscopically. **Impurities in Tartrate Powders.**

Alum Powders

The very successful application of cream of tartar soon led to the attempt to replace this comparatively expensive salt by something of a cheaper nature, and various acid sulphates and phosphates have been put upon the market. The alum powders belong **Alum Powders.**

to the sulphate class, and consist generally of calcined potassium or ammonium alums, or mixtures of aluminium sulphate with ammonium or potassium sulphate. When mixed with the right proportion of sodium bicarbonate, and treated with water, the following reaction takes place:—

Residues left in goods.

$$\underset{\text{Burnt potash alum.}}{K_2Al_2(SO_4)_4} + \underset{\text{Sodium bicarbonate.}}{6NaHCO_3} = \underset{\text{Aluminium hydrate.}}{Al_2(OH)_6} + \underset{\text{Sodium sulphate.}}{3Na_2SO_4} + \underset{\text{Potassium sulphate.}}{K_2SO_4} + \underset{\text{Carbon dioxide.}}{6CO_2}$$

Much controversy has raged around the use of these substances, and authorities have been pretty evenly divided as to the harmfulness, or otherwise, accompanying their use. It is claimed by those seeking to abolish their employment that the aluminium hydrate has a distinctly retarding action upon digestion, by coagulating and hardening the proteins of food, whilst the sodium and potassium sulphates are more powerful purgatives than tartrate salts. On the other hand, the very small quantities of these substances entering into finished foods, together with the long period during which they have been used without producing marked ill effects, are put forward as points in favour of the view that the danger to be feared is greatly exaggerated. Without expressing an opinion upon the physiological aspects of the question, it must be remarked that the use of alum in bread is strictly prohibited, and that the use of such powders in confectionery is also liable to be attended by unpleasant consequences in those districts where officials holding pronounced opinions upon this subject administer the Food and Drugs Act.

Test for Alum in Powders.

Alum is readily detected by means of the logwood test. A small portion of the powder to be tested should be made into a paste, with a little water and two cubic centimetres of a fresh alcoholic tincture of logwood added; then add another two cubic centimetres of saturated ammonium carbonate solution to ensure alkalinity. If alum is present, a more or less purple colour will result, becoming more pronounced on drying. In the absence of alum the colour will be pink.

The other sulphate powders in common use are potassium hydrogen sulphate and sodium hydrogen sulphate. The reaction with these salts is as follows:—

Residue left in goods.

$$\text{I.}\quad \underset{\text{Potassium hydrogen sulphate.}}{KHSO_4} + \underset{\text{Sodium bicarbonate.}}{NaHCO_3} = \underset{\text{Potassium sodium sulphate.}}{KNaSO_4} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon dioxide.}}{CO_2}$$

$$\text{II.}\quad \underset{\text{Sodium hydrogen sulphate.}}{NaHSO_4} + \underset{\text{Sodium bicarbonate.}}{NaHCO_3} = \underset{\text{Sodium sulphate.}}{Na_2SO_4} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon dioxide.}}{CO_2}$$

Both the residual salts are strongly purgative, and for this reason the sulphates are not to be recommended as constituents of baking powders.

Residues of Sulphate Powders.

The sulphates may be detected by making a solution of the powder, and filtering clear. To the clear solution add a few drops of hydrochloric acid until the solution is distinctly acid, then add a drop or two of barium chloride solution. A heavy white

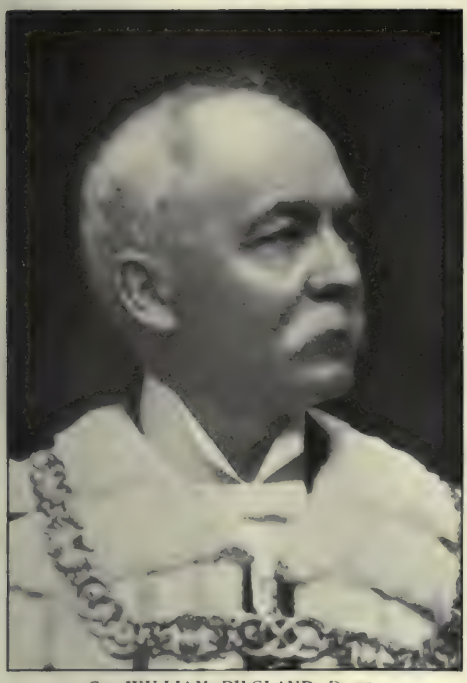
REPRESENTATIVES OF THE GLASGOW BAKING TRADE

SIR WILLIAM BILSLAND, BART., born in Stirlingshire in 1847, spent his early years on a farm, and in 1869 started business as a grocer in Glasgow. Three years later he opened a bakery, from which has developed the large firm of Bilsland Brothers, now including also the old-established concern of Gray, Dunn, & Co. Elected to the Town Council in 1886, he became Lord Provost and Lord Lieutenant of Glasgow in 1905. He is a fellow of the Society of Antiquaries of Scotland and a member of the Royal Scottish Geographical Society. He was created a Baronet in 1907.

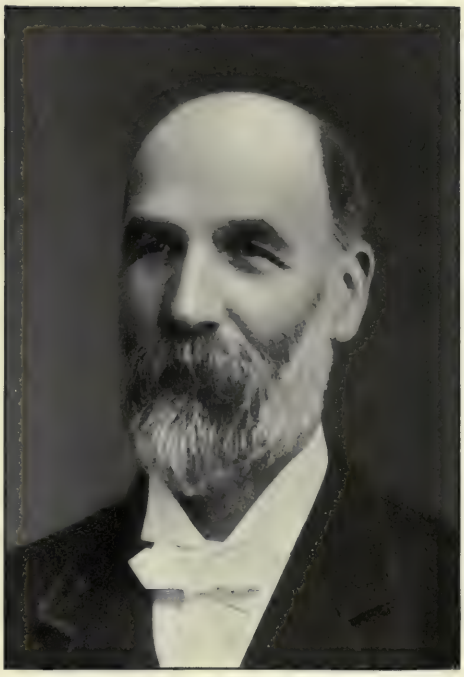
JOHN STEVENSON, born in Glasgow in 1847, was educated at the High School and Helensburgh Academy. He served an apprenticeship in a law office, but abandoned the law to join his father and brother in the business of corn and flour merchants. In 1867 the firm acquired a baking concern and installed machinery, then little used in bread-making. The business of J. & B. Stevenson has grown steadily, and now has large bakeries in Glasgow and London. Mr. Stevenson has been Deacon of the Incorporation of Bakers and President of the Corn Trade Benevolent Association.

JAMES MACFARLANE, born in Glasgow in 1857, was educated in the High School and University, and received his first business training in a shipowner's office. In 1878 he joined his father's baking firm of Macfarlane, Lang, & Co. He was President of the Scottish Association of Master Bakers in 1900. In 1893 he was Deacon of the Incorporation of Bakers, and in 1899 Deacon Convener of Trades.

WILLIAM BEATTIE, born in the North of Ireland in 1853, settled in Glasgow in 1866, and served his apprenticeship to baking. He started business on his own account in 1876, and is now head of the Dennistoun Bakery, which has a great reputation for hand-made bread. He is a leading member of the Royal Glasgow Institute of the Fine Arts.

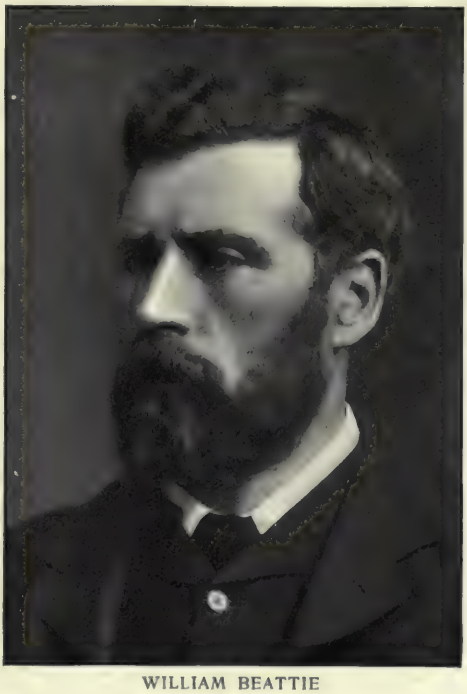


SIR WILLIAM BILSLAND, BART.



JOHN STEVENSON

JAMES MACFARLANE



WILLIAM BEATTIE

REPRESENTATIVES OF THE GLASGOW BAKING TRADE

precipitate indicates the presence of sulphates. Since alum will also yield this reaction, the logwood test should also be applied if it is desired to differentiate between alum and the alkali sulphates.

Phosphate Powders

The phosphate powders are by far the most successful substitutes for tartrates in baking powders, and most of the cream powders with which the market is now flooded are compounded with acid phosphates of calcium (lime), potassium, or ammonium, either alone or in admixture with proportions of tartrates and sulphates, and sometimes even alum.

Phosphate Powders.

The calcium salt is obtained by acting upon bone ash with just sufficient sulphuric acid to remove two-thirds of its calcium as calcium sulphate, thus converting the insoluble tricalcium phosphate into soluble acid calcium phosphate. These powders are very cheap as compared with tartrate powders.

Cream powders have no definite fixed composition, the compounding of them generally being trade secrets, and varying at the caprice of the manufacturers. The Horsford-Liebig powder, which is one of the oldest of these compositions, has the following proportions: Acid phosphate of calcium, 550 parts; sodium bicarbonate, 113 parts; potassium chloride, 100 parts. About 10 lb. of this mixture is recommended per sack of flour. One of the best-known proprietary self-raising flours in this country is also made with phosphate powder.

The reaction when acid calcium phosphate alone is used with sodium bicarbonate, is expressed thus—

$$\underset{\text{Acid calcium phosphate.}}{CaH_4(PO_4)_2} + \underset{\text{Sodium bicarbonate.}}{2NaHCO_3} = \overbrace{\underset{\text{Calcium hydrogen phosphate.}}{CaHPO_4} + \underset{\text{Disodium hydrogen phosphate.}}{Na_2HPO_4}}^{\text{Residues left in goods.}} + \underset{\text{Water.}}{2H_2O} + \underset{\text{Carbon dioxide.}}{2CO_2}$$

whilst with acid potassium phosphate it is expressed thus—

$$\underset{\text{Potassium phosphate.}}{KH_2PO_4} + \underset{\text{Sodium bicarbonate.}}{2NaHCO_3} = \underset{\text{Residue left in goods.}}{\underset{\text{Disodium potassium phosphate.}}{Na_2KPO_4}} + \underset{\text{Water.}}{2H_2O} + \underset{\text{Carbon dioxide.}}{2CO_2}$$

Good phosphate powders will yield 12 to 13 per cent of CO_2.

The great advantage of these phosphate powders is found in the low aperient action of the residual salts. Furthermore, the phosphates possibly have a certain dietetic value, and they are entirely free from the danger of contamination by lead, and also arsenic, if the acid used in their manufacture has been reasonably pure.

Properties of Phosphate Powders.

Ammonia Powders

All the baking powders hitherto dealt with leave a saline residue after the evolution of gas has been accomplished; the one we now have to

Ammonia Compounds.

consider differs from all of them in that it is completely resolved into gaseous compounds under the influence of heat. Ammonium carbonate, "volatile", or "vol", are the common names by which it is known. It is in reality, however, not ammonium carbonate, but a mixture of ammonium bicarbonate and ammonium carbamate. The substance occurs in hard fibrous lumps, which continually evolve ammonia gas. When treated with water, the powder is not decomposed with evolution of the gas, as in the case of other baking powders, but upon application of heat it is completely dissociated according to the following equation:—

$$\underset{\text{Ammonium carbamate and ammonium bicarbonate.}}{(NH_4)_2NH_2HCO_3CO_2} = \underset{\text{Ammonia.}}{3NH_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon dioxide.}}{2CO_2}$$

The whole of this powder, therefore, becomes gaseous; but although volatilized, it does not entirely escape from the goods during the baking, and so articles made with "vol" can generally be detected by the nose. It is more commonly used in biscuits than in any other goods. No danger whatever can attach to its use, and in this respect it is one of the safest of baking powders.

General Test for Aerating Agents.

The most important test to make when valuing a baking powder is the determination of available carbon dioxide, since upon this property depends its practical value to the baker or confectioner. The determination may be made very easily in a yeast-testing apparatus (fig. 8 in Vol. I, p. 86). A small flask should be attached to the apparatus by means of some rubber tubing. Bore the cork of the flask with two holes, and connect one by means of a piece of glass tube to the rubber tube. Through the other hole pass a thistle funnel completely to the bottom of the flask. Into the dry flask place about 2 gm. of the powder to be tested, then firmly fix the cork, and connect to the gas jar of the yeast apparatus, which should be filled with water. When all is ready, pour into the thistle funnel about 50 c.c. of water, and warm the mixture in the flask until gas ceases to be given off. Allow to cool, and read the volume of gas produced in the gas jar. Deduct the volume of water added, *e.g.* 50 c.c., from the number obtained, and the remainder will be the volume of gas given off by the weight of baking powder taken. The amount of CO_2 in "vol" cannot be tested in this manner, but it may be found by substituting dilute acid for the water in the foregoing experiment. Perhaps the best test for vol is to heat a portion in a porcelain dish. If pure the salt will be completely volatilized.

Other Methods of Aeration

Dauglish Aeration Method.

A method of aerating bread doughs, the invention of Dr. Dauglish, was introduced in 1856. It consists in impregnating the water used for dough-making with carbon dioxide under pressure. The solubility of all gases increases directly with the pressure, and it is possible, therefore, to cause water to take up very large amounts of gas by

suitable compression; this is indeed the principle of the manufacture of soda water and other aerated drinks.

In the Dauglish system the carbon dioxide was obtained by acting upon chalk with sulphuric acid, and absorbing the gas evolved in water in strong compression cylinders. The dough was then made in a closed apparatus similarly under pressure, so that the finished dough was really saturated with carbon dioxide gas. Upon baking, this gas by its expansion caused the vesiculation of the loaf. The method has been worked continuously since its inception, but has never been adopted by any manufacturers, except the company originally exploiting the process. It is well adapted to factory working, but requires too much special machinery to be capable of adoption by small craftsmen. The bread produced by this method is in most respects similar to other unfermented bread. It has the advantage over these breads, however, in being free from any saline residues of the reactions. The method has been modified in several respects since its introduction.

Many articles of confectionery depend for their aeration upon the use of eggs or other film-producing liquid. By far the most efficacious agent for this purpose is white of egg, which, by proper beating or whisking, can be made to form a stiff froth which will stand firm, and when heated will expand without bursting the walls of the vesicles. Gluten and blood albumen in a less degree also possess similar properties.

Raising Properties of Eggs.

Certain substitutes which are put forward for use in place of eggs, however, are of very small value. They generally consist of powdered gelatines, and though quite capable of being whipped into a lasting froth, yet they utterly fail to expand when put into the oven. The explanation for this difference in physical behaviour must be sought in the chemical nature of the substances. Albumens, of which white of egg is a typical example, when heated strongly are converted into insoluble substances generally of a flexible horny nature —in other words, the substance is capable of setting even in presence of much water. The gelatines, on the contrary, when heated in this way do not harden or set, but actually become softened, and in presence of sufficient moisture they melt and form thin liquids.

Egg Substitutes for Aerating Purposes.

Yolk of eggs can also be made to retain air by whipping, but not to anything like the same extent as whites, because of the smaller proportion of albumen yolk contains, and the presence of larger proportions of fat, both these factors tending to prevent the formation of strong films which produce a froth. This effect of oil or fat is at once apparent should any become accidentally mixed with white of egg which has been separated for beating purposes.

Raising Powers of Yolk of Egg.

Fat is largely used by the confectioner as an aerating and shortening agent, and familiar instances are to be found in puff and short paste, shortbreads, &c. The mode of operation of fat is best illustrated in puff paste, where the fat is first made to form a thick layer upon the sheet of dough, and then by successive foldings and rollings

Fat as an Aerating Agent.

the two layers are reduced to extreme thinness and piled upon one another. If such a dough is cut through, it may be likened to a number of sheets of paper closely pressed together, yet each sheet prevented from adhering to its neighbours by the grease film which covers it. Now imagine such a piece of dough brought into the oven. The moisture in the mass is slowly converted into vapour, and in expanding forces the layers apart, since the matter forming the layer is too closely compacted to open out on account of its impregnation with the melted fat. The paste is thus formed into a light friable mass consisting of very thin leaves.

The lifting power of moisture in puff pastes is not great, and consequently considerable care has to be taken not to exert too much force during working; else the layers become forced into one another, really lose their continuity, and allow the steam when produced to escape without lifting the layers, a heavy paste being the result.

Why Puff Paste rises.

In short pastes and shortbread the method of incorporating fat is different, and is not designed to bring about the formation of layers. The mechanical action of the fat is, however, quite similar to its effects in puff paste, for during the rubbing in, it coats the individual particles of the mixing, and isolates them from each other, thus preventing any lumping together. When heat is applied, the vapour formed in the interior forces these fat-surrounded particles away from each other, and a short or open crust is formed having no continuity of the binding agent.

Action of Fat in Short Paste.

CHAPTER XLII

BAKERS' FATS: BUTTER

All greasy substances obtained from animal or vegetable sources may be called oils whether they are solids (fats) or liquids. The whole of the bodies belonging to this class of substances possess the characteristics of unctuousness, *i.e.* greasy feel, insolubility and immiscibility in water, solubility in certain organic liquids, such as ether, chloroform, alcohol, carbon disulphide, benzene, turpentine, &c. They are all lighter than water, the specific gravity varying between ·910 and ·970. They form stains upon paper which cannot be evaporated.

General Properties of Fats.

Fats and oils have no boiling-point, and when heated to about 480°–570° F. they are decomposed, the oil becoming dark in colour and emitting much acrid vapour (acrolein) and carbon dioxide. When exposed to air and light, oils gradually undergo change, becoming paler in colour and eventually bleached, and acquiring a strong unpleasant odour and taste (*rancidity*). This change in odour and flavour of the oil is accompanied by an increase in the amount of free fatty acids; but it has been clearly shown by many observers that the quantity of free fatty acids cannot be used as a measure

Action of Heat on Fats.

Rancidity and its Cause.

of rancidity. Direct oxidation by contact with air, assisted by the action of light, is now considered to be the cause of rancidity. This action of air is greatly accelerated by the presence of nitrogenous matters in the oil, considerable amounts of which are always to be found in crude or badly refined oils. In consequence of its complex nature rancidity cannot be determined by purely chemical processes; taste is the ultimate criterion to determine whether a given oil is suitable for alimentary purposes.

Neutrality of Pure Oils.

Pure fats and oils are neutral in reaction, but owing to their exposure to light and air all commercial oils have a more or less marked acid reaction. With one or two exceptions (croton oil, castor oil), which contain certain toxic principles, all oils obtained from animal or vegetable substances are edible, though many are not used for that purpose in Europe by reason of certain harsh or peculiar flavours.

Chemical Composition of Oils.

In chemical composition all naturally occurring oils are now known to be complex mixtures of ethereal salts. The base present in these salts is *glycerol*, the acid radicals being various members of the group of *fatty acids*, the lowest member of which is acetic acid. The number of these fatty acids is very large. The most important for industrial purposes are the following:—

Acid.	Formula.	Acid.	Formula.
Butyric ...	C_2H_7COOH	Arachidic ...	$C_{19}H_{39}COOH$
Valeric ...	C_4H_9COOH	Oleic	$C_{17}H_{33}COOH$
Lauric ...	$C_{11}H_{23}COOH$	Linoleic ...	$C_{17}H_{31}COOH$
Palmitic ...	$C_{15}H_{31}COOH$		
Stearic ...	$C_{17}H_{35}COOH$		

All these acids are monobasic, *i.e.* they contain only one atom of replaceable hydrogen, and this is exhibited in the formula by separating the group containing this hydrogen. Glycerol belongs to the alcohol series of compounds. Its chemical formula is $C_3H_5(OH)_3$. The termination "in" is applied generally to all combinations of glycerol with fatty acids to form glycerides or fats, *e.g. butyrin, stearin, laurin, olein, linolein.*

Hydrolysis of Fats.

Like other salts these glycerides may be broken up into their constituent acids and glycerol by suitable reagents. The process in the case of fats is called *hydrolysis*. Thus treatment of a fat with steam at high pressure, or heating with sulphuric acid, yields glycerol and fatty acid according to the following equation:—

$$\underset{\text{Palmitin.}}{(C_{15}H_{31}CO_2)_3 \cdot C_3H_5} + \underset{\text{Water.}}{3\,H_2O} = \underset{\text{Glycerol.}}{C_3H_5(OH)_3} + \underset{\text{Palmitic acid.}}{3\,C_{15}H_{31} \cdot COOH}$$

This process is largely employed in the manufacture of candles, &c., and in the production of rancidity it probably also plays a part.

Saponification of Fats.

When certain other reagents, such as the alkalies, are employed to decompose fats the reaction is called *saponification*. In such

cases the alkali combines with the acid radical to form a new salt called a soap. This is represented by the equation—

$$\underset{\text{Olein.}}{(C_{17}H_{33}CO_2)_3C_3H_5} + 3\,\underset{\text{Sodium hydrate.}}{NaOH} = \underset{\text{Glycerol}}{C_3H_5(OH)_3} + 3\,\underset{\text{Sodium oleate (soap).}}{C_{17}H_{31}COONa}$$

When soda is employed a solid or hard soap results, and when potash is used soft soap is produced as a result of this combination. In baking, the use of excessive quantities of sodium carbonate as an aerating agent in goods containing fat would result in the conversion of some of the fat into soaps, with consequent decrease of nutritive and digestive properties, the soaps being slightly purgative in their action.

Action of Alkali on Fat in Baking.

The consistency of the fats and oils depends entirely upon the proportions in which the chief constituents are present. Now the chief constituents of all the common fats and oils are *stearin*, *palmitin*, and *olein*, the other glycerides occurring only in small quantity. Stearin is a hard solid fat at ordinary temperatures; palmitin is solid, but of a more buttery nature, whilst olein is liquid. In the hard solid fats, such as tallow and mutton fat, stearin predominates; in the softer solid fats, like beef fat, palmitin is present in largest amount, or, as in hog's fat, a considerable quantity of olein is present; whilst the liquid oils are composed chiefly of olein. This is of importance to the baker, for the tough character so important for paste-making will depend upon the presence of a due proportion of stearin and palmitin, and on the other hand sufficient of the softer olein must be present if a fat is to possess good creaming properties. The manufacturer of butter substitutes thus has it in his power to obtain either property at will, and there is no reason why the individual baker by judicious selection should not compound his own fats if he is prepared to take the trouble.

Basis of Different Fats.

Physical Properties of Bakers' Fats.

Fats are introduced into bread and confectionery for a variety of reasons. They increase the nutritive value; this, however, is by no means the primary reason for their use by the baker and confectioner. In bread they improve the texture and sheen, and impart richness to the eating qualities. In cakes and pastry they exert well-known shortening properties, and upon the body of the fat used depends largely the quality of the product. Finally, fat is used for the flavour it imparts. In this respect butter stands alone; all other fats, however well they may fulfil the other requirements, fail entirely to produce the characteristic mellow flavour yielded by pure butter.

Why Fats are used by the Baker.

Butter

Butter is the typical fat for confectionery purposes. It consists of the fat of milk, together with small quantities of curd, milk sugar, and salts. This substance is produced by churning milk, or more usually cream, by which process the tiny globules of fat are caused to coalesce and form

granules. The fine spongy mass, containing much liquid milk, is next worked to remove the liquid portion until it forms a homogeneous mass, which is then ready for market. The following is the average normal composition of pure butter according to König:—

Fat	87·0
Casein (curd) ...	0·5
Milk sugar ...	0·3
Ash	0·3
Water	11·7

Chemical Composition of Butter.

Owing to the method of manufacture, butter is liable to variations in its composition, chiefly in the percentage of water contained. It is illegal (Butter and Margarine Act, 1907) to sell butter containing more than sixteen per cent of water. Recently there has been put upon the market a mixture made by churning milk into butter; it is sold as *Milk-blended Butter*, but a distinctive name is to be devised for it by the Board of Agriculture. By this process the moisture is greatly increased, but the Act already referred to makes it illegal to sell this kind of butter with more than twenty-four per cent of water, and the actual percentage of water or moisture must be declared on the wrapper. The great fault to be found with such butter, apart from the excess of moisture, is its greatly deteriorated keeping quality, in spite of the presence of boric acid preservatives.

Water in Butter.

Milk-blended Butter.

Pure butter fat is a complex mixture of the glycerides of butyric, caproic, capric, caprylic, palmitic, stearic, and oleic acids. About 7 per cent of the fatty acids are soluble in water, and this very high percentage forms one of the most characteristic features of butter fat, so that upon a determination of these acids the analyst is frequently able to form an opinion of the purity of the sample. The composition of butter fat was found by Bell to be as follows:—

Composition of Butter Fat.

Butyric acid	6·13
Caproic, capric, and caprylic acids ...	2·09
Palmitic, stearic, and myristic acids ...	49·46
Oleic acid	36·10
Glycerol	12·54
	106·32

Of the insoluble fatty acids oleic is the most abundant, and consequently the melting-point of butter is very low, about 31° to 34° C. (88° to 93° F.). The fat of the human body is also largely composed of olein, and the close approximation of butter to human fat largely explains the ready digestibility of butter fat. Butter is very apt to turn rancid. Some of the glycerides become decomposed with liberation of the free fatty acids, notably butyric acid, which gives the butter a very offensive odour and flavour. This decomposition is largely dependent upon the presence of

nitrogenous matter in the form of curd; and when all foreign substances are removed from the fat, butter may be kept indefinitely. The butter is melted and kept hot until all water is driven off; this is known to be the case when all crackling ceases. The liquid fat is then strained through muslin, poured into bottles, and cooled. If kept well corked it will remain good for any length of time. In hot climates this process is extensively used (Indian Ghee).

Influence of Curd in Butter.

Perfectly pure butter is frequently almost pure white, and is seldom more than very pale yellow. For the market, however, it is usually coloured by means of vegetable colouring matters, *e.g.* annatto, turmeric, saffron, &c. Upon exposure to light butter loses its colour, and becomes tallowy in taste and smell. The peculiar aroma and flavour of butter are due to the presence of micro-organisms which take an active part in the ripening of the cream. This is proved by the fact that the desired odour and taste are not found in sweet cream butter, or butter made from sterilized cream, both of which have insipid flavours. This question has been very fully studied during recent years, notably in America, where pure cultures of the bacteria prepared in the laboratory have been distributed to the dairies; and by this means the well-known "June flavour", only found in certain districts for short seasons of the year, can now be artificially produced at any time.

Colouring of Butter.

Cause of Flavour.

Commercially butter is valued not only for purity as determined by chemical tests, but also for odour and flavour. Such valuation requires expert skill which can only be acquired after long experience. Adulteration is now practised upon a most extensive scale, but is practically confined to the admixture of small quantities of foreign fats, the non-fatty adulterants being too easy of detection. Adulteration has kept pace with the advance of analytical knowledge, and mixtures are now made which will closely conform to the standards of the public analysts. The detection of small quantities of foreign fats, such as lard, goose grease, cotton-seed oil, cocoa-nut oil, palm-nut oil, and margarine, involves the possession of considerable analytical skill, and should be entrusted to a trained chemist. The examination for water, curd, salt, and preservatives will, however, be found useful at times to detect the grosser forms of adulteration.

Commercial Value of Butter.

Adulterants in Butter.

Butter Analysis.

Moisture is best determined by drying 5 or 10 gm. of the sample at 105° C. (221° F.) in a small weighed dish until all crackling has ceased. Cool and reweigh; the loss is equivalent to water. The percentage is found by multiplying the loss by 100, and dividing by the weight of fat taken.

Salt.—The fat should be burnt off, preferably in a fume chamber. The residue may be taken as salt, and calculated as a percentage in the same manner as moisture. Salt in butter should not exceed 3 per cent in mild butters, but may rise to 5 or even 10 per cent in salt or pickled butters.

Curd or Casein.—Drive the water off a weighed portion of the sample

(5 gm.). Carefully decant the clear fat from the solid residue; then wash the residue with ether or hot amyl alcohol, decanting the liquid each time after the solid has settled. Finally, dry the residue and weigh. This represents curd and salt. Deduct the salt already found, and the remainder is curd.

Foreign Fats.—The fat may be examined by *Valenta's test*, which is useful for indicating admixtures of large amounts of foreign fats. A test-tube is graduated by running from a burette two quantities of 3 c.c. of water; make a file scratch indicating each graduation. Dry the tube and then introduce 3 c.c. of the melted clear fat and 3 c.c. of acetic acid of 99 per cent strength. Warm the mixture to 40° C. (104° F.), when, if the sample is butter fat, the contents of the tube will become clear. If margarine is present it will not dissolve below 75° C. (167° F.). The best way to carry out this test is by immersing a thermometer in the mixture. When the solution is clear, remove the tube from the flame, and while stirring observe the liquid carefully. As soon as a turbidity is seen following the bulb of the thermometer note the temperature. Another test useful for sorting out samples has been put forward by A. W. Stokes. Place a small portion of the unmelted butter upon a glass microscope slide; press a cover glass upon it, and examine with 1-in. or ½-in. objective with polarized light. Genuine butter appears almost uniformly dark throughout the whole field, but if crystalline fats like margarine are present, more or less well-marked lighting of the field will be observed. This test is rapid, but should not be accepted as conclusive, because old butters may show somewhat crystalline appearance.

Valenta's Test.

Microscopic Test for Butter.

Preservatives.—Formerly the only preservative added to butter was salt; but with the advance of chemical knowledge many other substances have been proposed. The chief substances used are: boric acid, salicylic acid, formalin, and fluorides.

Of these *boric acid* is the most important. There is a difference of opinion among dietetic authorities as to whether it is harmful or not. The recommendations of the Preservatives Committee limit the amount of boric acid which should be present in butter to ·5 per cent, and they strongly recommend that no preservative of any kind should be used in food intended for infants or invalids. The recognition of boric acid is comparatively easy. A portion of the butter should be reduced to ash after adding a little carbonate of soda. To the ash add a few c.c. of concentrated sulphuric acid and a little alcohol; then apply a light. If boric acid is present a green-tinged flame results. The reaction is delicate, allowing of the detection of ·01 per cent of the acid. Practically all imported butters contain some boric preservative.

Test for Boric Acid.

Salicylic acid is seldom used now. It gives a violet colour with ferric chloride. After extraction of the watery portion with ether evaporate the ether, take up the residue in a little water, and add a few drops of ferric chloride.

Test for Salicylic Acid.

Formalin is more frequently used in milk. It may be detected by Hehner's method. Add to a portion of the melted fat a little milk, and then carefully pour down the side of the tube an equal bulk of strong sulphuric acid. A violet colour at the junction of the liquids indicates the presence of formalin.

Test for Formalin.

Fluorides are now used at times, especially in butters coming from Brittany. Melt a portion of butter, separate the watery layer, and make it alkaline with carbonate of soda. Evaporate to dryness and put the residue in a lead or platinum dish; add a few drops of concentrated sulphuric acid and cover with a waxed watch glass upon which a few marks have been made with a sharp point. If fluorides are present the marks will be etched into the glass wherever exposed.

Test for Fluorides in Butter.

Renovated butter, or *process butter*, is largely made in the United States, where the output has reached some 5,000,000 lb. per annum. It is prepared from unsaleable, rancid butter by melting it and separating the fat from the watery layer and curd. The fat is next "blown" with air to remove the objectionable flavour, and then quickly cooled so as to prevent the separation of the liquid from the more solid fats. The cooled fat is afterwards churned again with fresh milk, to which suitable bacterial cultures have been added to obtain the requisite flavour. The milk sours and forms an artificial curd, which contains about the same amount of nitrogen as the curd of genuine butter. It is impossible to detect renovated butter by chemical methods, the proportions of the various constituents being usually carefully regulated to simulate pure butter. Crampton obtained the following mean percentage composition from some 75 analyses of renovated butter:—

Renovated Butter.

Fat	82·05
Curd	1·47
Ash	2·85
Water ...	14·44

Hess and Doolittle state that process butter does not yield a clear fat layer when melted even upon long standing, whereas genuine butter fat clears very quickly after melting.

Clarified Butter is a term often used by confectioners. This is butter which has been melted and from which the scum that rises to the top has been skimmed. This scum consists of the casein, and some of the water is also drawn off by heating.

Butter, suet, dripping, cocoa butter, &c., are rarely purified before sending to market. For most of these naturally occurring cooking fats substitutes are now manufactured by the admixture of various animal and vegetable oils and fats. To this there can be little objection from a sanitary or dietetic point of view, the use of the cheaper and quite as nutritive oils being perfectly legitimate so long as they are sold under their proper names.

General Composition of Edible Fats.

CHAPTER XLIII

BAKERS' FATS: MARGARINE, LARD, ETC.

Margarine

Butter substitutes were originally known by a vast variety of names, all of which are now suppressed by law in favour of margarine. The production of a satisfactory substitute for butter was worked out to a manufacturing process by the French chemist M. Mège Mouriès in 1870, at the instance of Napoleon III. All butter substitutes consist of mixtures of animal and vegetable fats and oil, coloured with annatto or some aniline dye, *e.g.* methyl orange. It is absolutely essential that the ingredients used be perfectly pure and fresh.

Butter Substitutes.

The animal oils generally used are oleo oil and neutral lard, both ingredients being prepared from the freshest beef or hog fat. The fat must be removed from the animal as quickly as possible, washed, sorted, and put aside to cool and harden. The fat is then shredded in a machine and finally ground into a pulpy mass. This is next put into tin-lined vessels and heated to not more than 45° C. (113° F.). The more liquid portion of the fat separates, and salt is freely spread over it to aid separation and clearing. This liquid fat, technically known as "premier jus", is run off into shallow trays and put aside to cool, when the bulk of the stearin separates as a solid. The crystalline paste is then cut up and the pieces brought into a hydraulic press, and the liquid fat separated. This oleo oil which runs from the presses forms the main ingredient of margarine.

Animal Fat Extraction.

Among the vegetable oils used cotton-seed oil and cotton-seed stearin are most frequently employed. The quality of the oil used depends upon the quality of margarine to be made, but in any case the oil must be perfectly free from fatty acids. The best cotton-seed oil is known in America as *butter oil*. Arachis, olive, and sesame oils are largely used in Europe, and recently refined cocoa-nut oil has come into use as a constituent of margarine. The oleo oil and vegetable oils, with a suitable proportion of pasteurized and skimmed milk, are next churned at a slightly raised temperature, the object being to prevent the tendency of oleomargarine to crystallize, and also to pulverize the mass into butter-like globules, producing a complete emulsion. After churning, the mass is cooled as rapidly as possible by circulating cold water through the jacket of the churning machine, and the margarine is then run into marble or slate cooling tanks. While running out, the mass is made to come in contact with a strong current of ice water, which thoroughly pulverizes the margarine and solidifies the globules of fat so as to resemble butter granules. The mass next goes upon a kneading table, where salt and colouring matter are worked in and excess of moisture is removed. The following

Vegetable Oils in Use.

Method of Margarine Manufacture.

Constituents in Margarine.

is claimed to be the composition of the three chief grades of margarine as made in the United States:—

	High-grade.	Medium.	Low-grade.
Oleo oil	100	315	459
Neutral lard	130	500	265
Butter	95	—	—
Cream	—	280	—
Cotton-seed oil	—	—	315
Milk	—	280	255
Salt	32	120	120
Colour	0·5	1·5	1·25

In low-grade products maize oil is sometimes used, but it imparts a grainy flavour to the margarine. In Europe lard is not used to any extent, and beef fat is substituted in this country exclusively. Mutton fat is used on the Continent, but it imparts an unpleasant animal flavour.

The chief object of the manufacturer is to remove the tallowy flavour which characterizes margarine, and, where allowed by law, this is usually accomplished by adding pure butter. In this country 10 per cent is the maximum amount of butter permitted to be used, in accordance with the act of 1899. Other methods consist in adding small proportions of volatile acids, aldehydes, and glycerides, or butter perfumes, which consist principally of volatile ethers such as propionic, butyric, and caproic ethers. Another important point aimed at is to produce a margarine which froths and browns like genuine butter when cooking. In genuine butter these properties are due to the presence of milk sugar and casein, and consequently the more milk that is used in making margarine the nearer this object is approached. In countries where the quantity of milk to be added is limited by law, patents have been taken out for the addition of a variety of substances said to produce similar effects. Among others, albuminoids, casein, waxes, bees'-wax, and cholesterol may be mentioned. The average composition of margarine is as follows:—

Average Composition of Margarine.

Water	9·3
Proteid (curd) ...	1·3
Fat	82·7
Ash	6·7

From this it will be seen that the fat is present in almost the same proportion as in average butter. The composition of the fat differs from that of genuine butter in the relatively large amount of stearic acid and very low percentage of the soluble fatty acids, as evidenced by the following partial analysis of Partheil and Ferie:—

Nature of Fatty Acids in Margarine.

Stearic acid	19·14
Palmitic acid	6·08
Myristic acid	14·33
Lauric acid	7·04
Unsaturated acids, *e.g.* Oleic, &c.	47·06

The low amount of volatile fatty acids may even be claimed as a point in favour of margarine, since when butter turns rancid it is these volatile acids which are liberated and cause the unpleasant flavour and odour. The smaller quantities of protein are also in favour of margarine, since there is less tendency to rancidity. From a physiological point of view there is still some difference of opinion. It is held by some authorities that margarine is less digestible than butter, but, on the other hand, Hutchison is of opinion that margarine is almost as completely absorbed as butter, 102 lb. of margarine being equivalent to 100 lb. of butter. The deficiency of soluble fatty acids in margarine has been to some extent overcome of late by the use of cocoa-nut oil and palm-nut oil, which are being used in some margarines to the extent of 30 to 40 per cent.

Keeping Properties of Margarine.

Hehner gives the following as a good test for margarine which contains no butter. Heat a portion of the fat with a small quantity of alcoholic caustic potash. If any butter is present there will be an odour of ethyl butyrate (pear essence). With margarine containing no butter no such odour will be obtained.

Test for Margarine.

The melting-point of margarine ranges from 34° to 40° C. (93°–104° F.), and its specific gravity is ·859–·863.

Vegetable Butters

In order to supply the huge population of India, whose religious tenets forbid the use of beef or hog fats as food, a butter substitute was prepared from cocoa-nut oil and palm-nut oil. It has, however, since found considerable favour in Europe among vegetarians, and is also extensively used in confectionery and as a cooking fat. It is sold under a great variety of fancy names, *e.g.* lactine, végétaline, cocaline, laureol, nucoline, palmine, cocose, albene, kunerol, &c. The best brand of cocoa-nuts (Cochin) is used for the preparation. The selected kernels are ground and pressed in hydraulic presses. The oil obtained is purified and freed from fatty acids by treatment with alcohol and charcoal, or by neutralizing with magnesia. The resulting butter is a soft white fat, consisting practically of pure cocoa-nut or palm-nut oil.

Vegetable Butters.

Another kind of vegetable butter consists almost entirely of cotton-seed stearin (see p. 260); it is known as "vegaline", "cottolene", "electol", &c.

Lard

Lard.

Next to butter, lard is the most important fat used in confectionery and baking, and for many years it was the only substitute for butter. The term lard is now applied to all fat obtained by melting hog's fat, from whatever part of the animal it is obtained. At one time, however, the term was limited to fat obtained from the omentum or leaf (kidney and bowel membrane). The great bulk of the lard coming into commerce is manufactured in America, and according to Dr. Wiley it is usual to recognize the following classes:—

Grades of Lard.

Neutral No. 1 or *Leaf Lard* is rendered from pure leaf carefully selected, at temperatures of 45° to 50° C. (113° to 122° F.). The resulting fat is practically neutral, and is used exclusively in the manufacture of margarine.

Neutral No. 2.—This consists of back fat rendered at the same temperature, and as carefully as No. 1. It is chiefly used by bakers, biscuit-makers, and confectioners.

Kettle Lard.—This is a harder lard, obtained from the residues from No. 1 lard rendered under pressure. This lard has a melting-point about 45° C. (113° F.).

Prime Steam Lard.—This is an inferior variety obtained from trimmings and all fat parts of the animal. Melting-point about 38° C. (100° F.).

Properties of Lard.

Pure lard has a salve-like consistence and granular texture. In colour it is perfectly white, and it possesses an agreeable taste. The lower qualities are somewhat insipid in flavour. Fresh lard is practically neutral, but upon exposure to air it gradually becomes acid in reaction. Pure lard varies in specific gravity from ·931 to ·932, and in melting-point from 42° to 48° C. (107° to 118° F.). The fatty acids present in lard are palmitic, stearic, oleic, lauric, myristic, the oleic being the predominating acid.

"Refined" Lard, &c.

Lard is largely adulterated. At one time the product was always sold as "refined lard". Some refined lards coming from America have been found upon analysis to consist entirely of cotton-seed oil, mixed with just sufficient beef stearin to give it the requisite consistency. The application of the Food and Drugs Act has caused these products to be marketed as "compound lards" during recent years. It is claimed, however, in America that cotton-seed oil improves lard, whilst the addition of 5 per cent of beef stearin is said to be necessary to stiffen it. Artificial lard solidifies to a coarsely crystalline mass with a polished surface, whilst genuine lard is finely crystalline, with a dull wrinkled surface. Owing to the practice of feeding hogs upon maize and cotton-seed cake, modern lards are much softer and more buttery than formerly. Indeed, lard rendered from such hogs will yield the special tests for cotton-seed oil, so that positive results with the Halphen or Becchi tests cannot be taken as evidence of fraudulent adulteration. An older

form of sophistication, seldom practised now, consisted in the addition of water. This was accomplished by beating the lard with water in whisking machines.

Pure lard should be neutral, and of a bland pleasant taste and odour. When melted practically no water should be found in it, and the fat should be quite clear and free from suspended particles of membrane, &c. Lard substitutes consist chiefly of lard stearin, or lard mixed with beef fat, cotton-seed stearin, cotton-seed oil, maize oil, arachis oil, sesame oil. These substitutes are made by simply churning the molten fats and oils together, and then cooling rapidly. Lard Substitutes.

Artificial Suets

Artificial suets are cooking fats sold as substitutes for suet or dripping. They are generally mixtures of suet, tallow, and cotton-seed stearin. They possess a consistence between that of tallow and lard which depends upon the quantity of cotton-seed oil present. Such fats are sometimes flavoured with onions, &c., to resemble dripping more closely. Artificial Suets.

Chocolate Fats and Cocoa Butter Substitutes

The manufacture of chocolate, calling, as it does, for the employment of large quantities of cocoa butter, a demand has arisen for cheaper fats to take its place. For this purpose animal fats are unsuitable, because they impart a distinct flavour to the chocolate which is unpleasant. Vegetable fats are therefore chiefly used. At present refined cocoa-nut and palm-nut oils are used. The pure oils being too soft, the stearins are separated in the same way as oleo stearin, that is, by melting and cooling the fat to crystallizing point, then pressing the pasty mass to remove the olein. According to the time the mass remains under pressure, so the melting-point of the residual stearins becomes higher. The melting-point of these stearins is still too low for manufacturing purposes, however, and they are therefore strengthened by the addition of small amounts of animal fats. In examining such fats the most important fact is to determine the melting-point. It should be about 31° to 33° C. (88° to 91° F.).

CHAPTER XLIV

EDIBLE OILS

Most vegetable oils are suitable for edible purposes and preserving; hence practically all the oils may be and are employed thus. In India, for instance, both rape and linseed are readily marketable for food, though they are seldom used in Europe, being substituted by the smoother flavoured oils, such as olive, cotton, and sesame oils. Oils Edible Oils.

intended for food purposes are always refined by physical methods, the use of mineral acids as purifying agents introducing objectionable flavours. Alkaline reagents are not so bad, and are used to some extent. The general method of refining consists in extracting the oil by hydraulic pressure in the cold—"cold-drawn". The crude oil is then treated with boiling water or steam, and filtered to remove suspended matter and moisture. If it is necessary to decolorize the oil, it is treated with charcoal or fuller's earth and again filtered under pressure. Chief attention is directed to as complete a removal of free acids, mucilaginous and albuminous bodies as possible, since their presence predisposes the oil to rancidity. Edible oils should not congeal at low temperatures. As a rule olive oil conforms to this demand, but many other oils, such as cotton-seed oil, must be "demargarinated" before marketing. Cotton-seed oil deposits stearin at 40° F., and originally demargarinating was accomplished by storing it through the winter, when the stearin deposited and the clear oil could be decanted off. In modern establishments the oil is cooled in refrigerators and the separation made by filter-pressing the pasty sludge. The term edible or table oil is no longer to be regarded as denoting a single oil. Practically all table oils are now blends, and it is only when such are sold as olive or other specific oil that these mixtures are to be considered as adulterations. All natural oils are slightly acid in reaction; a perfectly neutral oil is insipid in flavour.

Olive Oil

Olive oil, also called *salad oil* and *sweet oil*, has a specific gravity at 15° C. (59° F.) of ·914; solidifying-point, 3°–4° C. (37°–39° F.) It is obtained from the fruit of the thornless olive, *Olea europæa sativa*. The finest oil is expressed from hand-picked and peeled olives; a second grade is obtained from the whole olive, and low grades from the kernels by pressure and the use of solvents. Olive oil varies greatly in colour; good oils may be anything between colourless and golden yellow. Some oils are tinged green owing to the presence of dissolved chlorophyll; these are generally low-class oils. The value of olive oil depends greatly upon its flavour, and this varies with the locality in which the olives are grown. The Tuscany fruits generally possess a more agreeable flavour than those grown in the Ligurian district. The rank, harsh taste of some of these oils disappears upon keeping some time. The fatty acids of olive oil consist principally of oleic, linoleic, palmitic, and arachidic acids. On account of its high dietetic value olive oil is adulterated enormously, the commonest adulterant being cotton-seed oil, which is frequently entirely substituted for it. Other oils used for this purpose are sesame, rape, poppy, arachis, and lard oils. The detection of certain of these substitutes is not particularly difficult when they are present in considerable quantity, but the ingenuity of the adulterator is directed chiefly to the addition of a small quantity of a mixture of oils which have

Olive Oil.

Adulteration of Olive Oil.

the effect of neutralizing each other, so that detection of the fraud becomes a matter of great delicacy which can only be successfully undertaken by an expert oil chemist. The following oils can be detected when present in large quantity, or substituted entirely for olive oil:— Tests for Adulterants.

Pea-nut oil reveals its presence by the bean-like odour and flavour which it possesses.

Lard oil yields the characteristic odour of lard when a portion of it is warmed.

Cocoa-nut oil in from 12–15 per cent admixture causes the sample to solidify when placed in ice water.

Cotton-seed oil may be detected by the Becchi test (see under Cotton-seed oil, p. 260).

Sesame oil can be recognized by means of Baudouin's test (see under Sesame oil, p. 261).

Almond Oil

Almond oil has a specific gravity at 15° C. (59° F.) of ·914–·920; solidifying-point, −10° C. (+14° F.). This oil must not be confounded with oil of bitter almonds, *i.e.* essence of almonds (see Chap. L, p. 291). The oil is expressed from the seeds of the sweet and bitter almond tree, *Prunus amygdalus dulcis* and *Prunus amygdalus amara*. In colour it is pale yellow, and it has a bland taste. The oil is largely adulterated, but usually only with peach kernel or apricot kernel oil; indeed much foreign almond oil consists entirely of these oils. Peach kernel oil may be detected by shaking 3 parts of the oil with 1 part nitric acid of 1·4 specific gravity. Almond oil yields a light-yellow colour turning brown, whilst peach kernel oil gives a bright-red colour. Almond oil consists almost entirely of olein, and as it does not become quickly rancid it is used to a large extent in pharmaceutical preparations. Almond Oil.

Arachis Oil

Common names for this oil are *pea-nut, ground-nut,* and *earth-nut oil.* Its specific gravity at 15° C. (59° F.) is ·919; solidifying-point, −2·5° C. (+27·5° F.). This oil is extracted from the seeds of the creeping plant *Arachis hypogæa,* a member of the order Leguminosæ. The best-quality oils are obtained by cold pressure of the dried seeds; they are colourless, and possess a pleasant kidney-bean flavour. By further pressure of the moistened residues a yellow oil of inferior value is obtained, which is sometimes sold as *butterine oil.* In its chemical and physical characters arachis closely resembles olive oil, of which it frequently forms an adulterant. When present in only small amount its detection is a matter of considerable difficulty, depending upon the separation of arachidic acid, a fatty acid peculiar to this oil, and occurring to the extent of about 5 per cent. When arachis oil is used in large Arachis Oil.

quantity in admixture with other oils its peculiar odour and flavour will enable it to be recognized. Arachis oil is largely produced in Holland and France, in which countries it is used as a substitute for olive oil, and also to a very large extent in the making of confectionery.

Cotton-seed Oil

Cotton-seed oil has a specific gravity at 15° C. (59° F.) of ·922 to ·930; solidifying point, 3° to 4° C. (37° to 39° F.). This oil is obtained from the seeds of various species of *Gossypium*, belonging to the mallow order, now cultivated in India, Egypt, America, &c. The seeds are hulled and then crushed, the mass being then placed in bags and submitted to hydraulic pressure, first in the cold and afterwards hot. The oil expressed from the seeds is dark red, almost black. On treating with caustic potash the upper layers become blue and afterwards violet, a characteristic reaction of cotton-seed oil. Just sufficient caustic is added to carry down these colouring matters in the soap formed, and the clear oil is then drawn off and washed. The refined oil is pale yellow in colour, possessing a bland taste and pleasant odour. Owing to the method of refining with alkalies, cotton-seed oil usually contains only about 1 per cent of free fatty acids. Cotton-seed oil is very suitable for edible purposes, but owing to popular prejudice its sale under its proper name has been very restricted, and it is generally marketed under some fancy designation, as table oil, sweet-nut oil, butter oil, &c. In addition to this it is frequently used to adulterate olive oil, and it enters largely into the manufacture of cooking fats, margarine, and compound lards. Commercial oils are known as *Summer Oils* and *Winter Oils*, the difference being that, from the winter oil some of the stearin has been removed, so that the oil will no longer solidify during cold weather. Such oil is said to be "demargarinated". The by-product, or solid *cotton stearin*, is a yellow buttery fat, largely used in the manufacture of margarine, compound lard, vegetable butter, and cooking fats. Cotton stearin has a melting-point about 40° C. (104° F.). For baking and confectionery this cotton stearin forms an excellent butter substitute even when used alone, whilst the confectioner possessing a whisk or beating machine can compound his own substitutes, using cotton stearin as his base and blending in butter, lard, or other oil, according to the consistency he desires his fat to have.

Cotton-seed Oil

Cotton Stearin.

Cotton-seed oil may be detected by the following test. Dissolve 1 gm of silver nitrate in 100 c.c. of 95-per-cent alcohol; add 20 c.c. of ether and 1 drop of nitric acid. If 2 c.c. of this reagent is well shaken with 10 c.c. of the oil under examination and then placed in boiling water for ten minutes, a blackening due to reduced silver will prove the presence of cotton-seed oil (Becchi's test). This test cannot be relied upon as proof of the adulteration of butter or lard with cotton-seed oil, because it has been shown that, when cows

Becchi's Test.

or hogs are fed upon cotton-seed cake, the butter or lard obtained from such animals yields the cotton-seed test.

Maize or Corn Oil

Maize oil has specific gravity at 15° C. (59° F.) of ·852; solidifying-point, 16°–14° C. (61°–57° F.). The germs of maize contain some 20 per cent of oil. In the process of starch and glucose manufacture these germs are separated; they are then submitted to hydraulic pressure, a yield of 15 per cent of oil being obtained. Maize oil is golden yellow in colour, possessing a pleasant odour and flavour like fresh grain, by which it may be identified. Maize oil contains a large amount of unsaponifiable matter, chiefly consisting of lecithin, a phosphorized fatty substance. The fatty acids present are palmitic, stearic, and arachidic. The supply of this oil comes chiefly from the United States, where it is largely used in the manufacture of margarine and compound lard. It is also used as an adulterant of olive oil.

Maize Oil.

Sesame Oil

This oil is also called *gingili oil* and *teel oil*. Specific gravity at 15° C. (59° F.) ·923; solidifying-point, −5° C. (+23° F.). It is obtained from the seeds of *Sesamum orientale* and *S. indicum*. The cold-pressure oil is pale yellow and free from odour, with a pleasant taste. The fatty acids are chiefly oleic and linoleic. In edible value it is equal to olive oil, of which it is a probable adulterant. Sesame oil when present in even small quantity can be recognized by the following test. Dissolve ·1 gm. of cane sugar in 10 c.c. of hydrochloric acid of 1·2 specific gravity. To this add 20 c.c. of the oil to be tested; shake thoroughly and allow to stand. If sesame oil is present the watery layer will become crimson (Baudouin's test). The test is capable of indicating 2 per cent of sesame oil.

Baudouin's Test for Sesame Oil.

Rape or Colza Oil

Rape or colza oil has a specific gravity at 15° C. (59° F.) of ·914–·917; solidifying-point, −4° to −6° C. (+25 to 21° F.) It is obtained from the seeds of a variety of *Brassica campestris*, the wild form of the turnip plant. The seeds of several allied plants are also used, all these oils being known as rape oil in this country. The crude oil is purified by treatment with sulphuric acid, and afterwards with alkali. The refined oil is dark yellow in colour, with a harsh unpleasant taste. The cold-drawn oil is used as food in India, and it has been used for baking purposes in this country when lard and other fats reach a very high price.

Rape Oil.

Cocoanut Oil

The specific gravity of cocoanut oil at 15° C. (59° F.) is ·925; solidifying-point, 20·5° C. (69° F.). It is obtained from the fruit of *Cocos nucifera*,

there being three qualities. The best, or Cochin, is grown on the Malabar coast. Ceylon is also a good quality, and both these varieties are prepared where cultivated. Copra is the common grade prepared in Europe from dried imported kernels. The oil is extracted by pressure and refined by heating with water. It is a soft, white, butter-like solid at ordinary temperatures. The fresh oil has an agreeable odour and flavour, recalling its origin, but it speedily becomes rancid. The fatty acids present are palmitic, oleic, myristic, and lauric. For edible purposes only selected nuts are employed. The free acids and odour are removed by means of alcohol and charcoal or magnesia, the resulting fat being almost neutral, and possessing only the faintest odour. Most of the well-known brands of vegetable butter consist simply of this cocoa-nut oil, and under various names it is extensively used in confectionery and biscuit-making. Recently it has acquired a new interest, as it is being used in the adulteration of butter. The ordinary chemical constants of this oil are closer to those of butter than those of any other fat, and consequently the detection of small quantities of it when used as an adulterant is only possible by careful comparison of all the constants of a suspected sample with those of a genuine butter.

Cocoanut Oil.

Butter Properties of Cocoanut Oil.

Palm-nut Oil

The specific gravity of palm-nut oil at 99° C. (210° F.) is ·873; melting-point, 23° to 28° C. (73° to 82° F.). This oil is obtained from the kernels of the fruit of *Elœis guineensis* and *E. melanococca* after the fleshy part has been removed. The method is similar to that used for obtaining cocoa-nut oil. Palm-nut oil is a white, neutral, pleasant-smelling solid having an agreeable nutty taste. Palm-nut oil usually contains much free fatty acid, usually 3 to 13 per cent, reckoned as oleic acid. The chief constituent of palm-nut oil is lauric acid. The chief use of palm-nut oil is as a constituent of vegetable butters. For this purpose its melting-point is too low, and therefore the more liquid oil is separated from the stearins by hydraulic pressure. The solid stearins resulting from this process are used in making vegetable butters, adulterating genuine butter, and also for making substitutes for cocoa butter for use in chocolates.

Palm-nut Oil.

Palm Oil

Palm oil has a specific gravity at 15° C. (59° F.) of ·92; solidifying-point, 38° C. (100° F.). This oil is obtained from the fleshy part of the palm-nut. It varies greatly in colour from orange yellow to dirty red, and possesses a pleasant violet-like odour. The oil is used as food by European and native alike in Africa, but owing chiefly to bad methods of extraction it is so rancid upon arrival in Europe that it is quite unfit for food. It is common for this oil to contain 20 to 50 per cent free acids. Its chief use, therefore, is for soap-making.

Palm Oil.

CHAPTER XLV

SUGARS AND SACCHARINE MATERIALS: CANE AND BEET SUGARS

Nearly all the natural substances employed as sweetening agents belong to the group of chemical compounds called the carbohydrates, of which they constitute the largest division under the name of sugars.

The sugars are found in almost every plant structure, fruits, stems, leaves, and trunks of trees, the most commonly occurring sugars being cane sugar and fruit sugar. The following table is an abstract of a large one given by Buignet showing the average quantities of sugar occurring in fruits:— **Sources of Sugar.**

	Sucroses or Disaccharides.	Reducing Sugar or Monosaccharides (Glucose type).
Apricots	6·04	2·74
Pineapples	11·33	1·98
Figs	0·00	11·55
English cherries ...	0·00	10·00
Strawberries ...	6·33	4·98
Raspberries	2·01	5·22
Oranges	4·22	4·36
Apples	5·28	8·72
Pears	0·36	8·42
Grapes (hot-house) ...	0·00	17·26

On account of their great solubility, and consequent ease of absorption into the system, the sugars form one of the most important groups of nutritive substances. The process of digesting starch involves its conversion into sugars, so that the transformation of starchy and other carbohydrates into sugars, which takes place in the plant tissues during the period of ripening, is a true predigestion of great utility to the animal economy.

Of the large number of sugars entering into the various food-stuffs only a few are of practical and commercial importance, and they are conveniently classified by division into two groups:— **Sucroses and Glucoses.**

1. The *sucroses* or *disaccharides*, the formula for which is generally written $C_{12}H_{22}O_{11}$. The principal members of this group are cane sugar, beet sugar, maple sugar, palm sugar, malt sugar, milk sugar.

2. The *glucoses* or *monosaccharides*, having the formula $C_6H_{12}O_6$, the chief members of which are dextrose or grape sugar, levulose or fruit sugar, and invert sugar, a mixture of the two former sugars found naturally in honey. Glucose or starch sugar is another name commonly applied to dextrose.

The members of these two groups are intimately related, and invariably the addition of a molecule of water to the disaccharides brings about their dissociation into two molecules of a monosaccharide in accordance with the following equation:—

Changes from Cane Sugar to Glucose.

$$C_{12}H_{22}O_{11} + H_2O = 2C_6H_{12}O_6.$$

This reaction may be brought about either by prolonged boiling with water in presence of air, or more rapidly by means of very dilute acids. It is naturally induced by certain plant and animal ferments.

Cane and Beet Sugar

Cane sugar or sucrose originally obtained its name from the fact that it was exclusively prepared from the sugar cane (*Saccharum officinarum*). It is the most commonly occurring of the natural sugars, and by reason of its powerful sweetening properties is technically of greatest importance. In these days, when it is computed that in this country the annual consumption of sugar reaches 80 lb. per head, it is difficult to realize that what is now regarded as so essential an article of diet was a few centuries ago a most expensive luxury, the use of which was practically confined to medicine. One of the earliest official records of the use of sugar in this country is to be found in the Scottish Chamberlain's Records for the year 1319, when its price was 1*s.* 9½*d.* per lb.

The sugar of commerce is chiefly obtained from two sources, about two-thirds of the world's supply being yielded by the sugar beet, and one-third by the sugar cane. In this connection it must be understood that, when properly refined, the sucroses, from whatever source they are obtained, are identical in all chemical characteristics, and it is only possible to differentiate them when, owing to imperfect refining, some impurities are left in them.

Commercial Sugars.

Cane Sugar.

The composition of sugar cane and the juice yielded by it is given as follows in Thorpe's *Dictionary of Applied Chemistry*:—

	Canes.	Juice.
Water	71·04	79·4
Sugar	18·02	19·6 (crystallizable). ·3 (uncrystallizable).
Cellulose	9·56	—
Albuminous matters	0·55	0·37
Fatty and colouring matters	0·35	—
Soluble salts ...	0·12	0·25
Insoluble salts ...	0·16	
Silica	0·20	

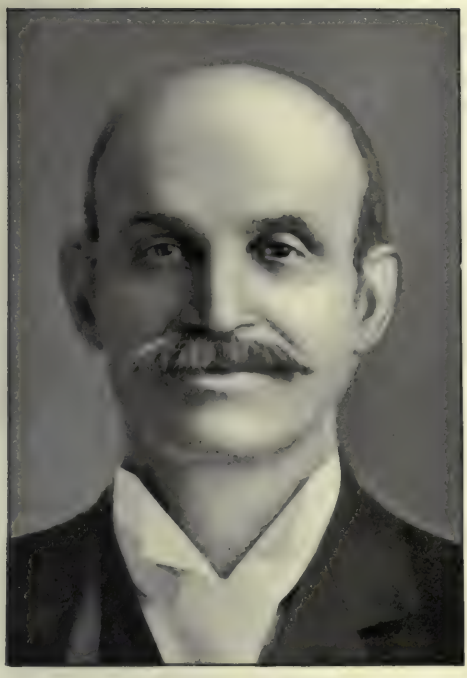
LEADERS IN THE EDUCATIONAL MOVEMENT OF THE ALLIED TRADES

ALEXANDER GRANT WYLIE, born at Crieff in 1845, served an apprenticeship to a baker in his native place. He soon migrated to London, and in 1870 started there on his own account. He is now a leading family baker, and has done much for trade organization in the capital. In 1898 he was President of the London Master Bakers' Protection Society, and he is the prospective President for 1908 of the National Association of Master Bakers. In 1907 he was appointed a Governor of the Borough Polytechnic Institute, as representative of the National Association. He is a Councillor and Alderman of Islington.

ADAM LAWSON JOHNSTON, born in Edinburgh in 1851, the son of a baker, commenced business on his own account in Edinburgh in 1880. He afterwards went to South Shields, and ultimately to London in 1886, when he started his present successful business in Wimbledon. He is a Vice-President of the National Association, and has several times declined the Presidency for health reasons. He was for many years Chairman of the Association's Education Committee, and was the first practical baker to be appointed an examiner under the City and Guilds of London Institute. He is now Honorary Consulting Examiner. He was Chairman of the Exhibition Judges for several years, and was one of the chief founders of the National Bakery School.

CHARLES H. PAUL, born in London in 1853, started business in Finsbury after considerable experience as journeyman and as manager of Boland's at Chester. He has since been in business as a confectioner and caterer in several parts of Greater London, since 1902 at Ealing. He has been one of the Confectionery Judges at the Annual Exhibition from the first. He is a member of the National Association's Education Committee and an Examiner under the City and Guilds of London Institute.

JAMES D. GRAHAM, born at Dunblane in 1854, served his apprenticeship as a baker in his native town, and afterwards went to London. He acquired an extensive experience there and started on his own account near Covent Garden, and afterwards at St. John's Wood. He is a Vice-President and a Trustee of the National Association, one of the Exhibition Judges, and an Examiner under the City and Guilds of London Institute. In 1900–1901 he was Chairman of the Master Bakers' Pension and Almshouse Society.



ALEXANDER G. WYLIE
(London)

ADAM L. JOHNSTON
(London)

CHARLES H. PAUL
(London)

JAMES D. GRAHAM
(London)

LEADERS IN THE EDUCATIONAL MOVEMENT OF THE ALLIED TRADES

The process of extracting sugar consists in crushing the canes, and the crude juice is collected and freed from organic acids and nitrogenous matter by heating and treatment with lime (defecation). The clarified juice is next concentrated by evaporation *in vacuo*, and the resulting syrups allowed to crystallize. About 87 to 91 per cent of raw, brown, or "muscovado" sugar is thus obtained, which is separated from the mother syrups, consisting of uncrystallizable sugars, by drainage, or, in modern sugar works, by means of centrifugals.

The crude syrup remaining is called *molasses*. It has a dark-brown or greenish-black colour. Formerly this residue found a market in London in large quantity, and was known as *black treacle*. Its chief applications were in cookery and distilling. Modern methods of extracting the sugar have greatly reduced the quantity of this residue, however, and comparatively little of it now reaches the market. The spirit rum was formerly exclusively obtained from molasses. **Molasses.**

Before the advent of beet sugar, the operations of sugar-winning from the cane were very crudely performed on the plantations, being practically confined to crushing the stems to expel the juice, and then concentrating the liquor in open pans. The pasty crystalline mass, which was of a blackish hue, was then packed into bags and despatched to the various European refineries.

Foot sugar was the name given to this dark-brown to black pasty mass, which was frequently very dirty. It was imported in enormous quantities at the great refining centres of London, Liverpool, Greenock, and Glasgow. With the installation of modern extracting plants at the plantations this supply has now nearly ceased. The syrups are worked more completely into crystalline sugars, so that only better-grade muscovado sugars now leave the plantations, the impurities being retained and used for manuring the land. Foot sugar found some applications in confectionery, chiefly in the production of rich wedding and other cakes. Its dark colour and large content of non-crystalline sugars were the characters for which it was chiefly prized. **Foot Sugar.**

The raw sugars, brown or grocery sugars, now chiefly coming to market are the impurest forms of sugar now met with in commerce. They are all muscovados, differing from one another according to the degree of "curing" they have undergone. "Curing" is the technical term for the whitening or bleaching which results from a more perfect separation of the uncrystallizable syrup from the crystals. The earlier methods of curing simply consisted in packing the moist sugars into barrels having perforated bottoms upon which rushes had been spread. The syrup thus drained away, and was collected in tanks. Modern methods consist in whirling the sugars in centrifugal machines, so that the syrup is thrown off. **Raw Sugar.**

Of the moist sugars now entering the market, the following may be noted: *Barbados*, usually dark-brown to reddish in colour; *Demerara*, of a golden colour and rich flavour, generally highly prized for domestic

purposes; *Brazilian*, a white sugar possessing a fine characteristic flavour, and hardly any residue of syrups; *Cuban*, dark-coloured, and frequently harsh flavour. These sugars are moist to the touch, and adhere in lumps owing to the relatively large quantity of syrup present. These raw sugars usually possess characteristic flavours in addition to sweetness, which are due to the presence of small amounts of non-saccharine bodies and aromatic substances.

Moist Sugars.

Beet sugar, prepared from the sugar beet (*Beta vulgaris*), is produced chiefly in Germany, France, Belgium, and Holland. In Britain the attempt to introduce the industry has not yet been attended with success. The common forms of beetroot contain but little sugar (about 6 per cent), and the chief difficulties to be overcome in extracting from the roots consisted in the separation of much acrid matter from the product, and the very low percentage of recoverable sugar. Scientific culture, however, has succeeded in so improving certain strains of beetroot, that they now yield 12 to 18 per cent of recoverable sugar, whilst the acrid substances are present in greatly reduced amount. The method of extraction consists in slicing or rasping the roots, and treating with water. The liquors obtained are defecated and clarified, and then evaporated *in vacuo* by methods similar in principle to those used in the case of cane sugar, but adapted to the special requirements of the beet.

Beet Sugar.

The raw sugars, whether obtained from sugar cane or beetroot, are generally refined in special factories devoted entirely to that work. The process of refining simply consists in dissolving the raw sugars in water, filtering and clarifying by means of special reagents, and decolorizing by means of animal charcoal. The use of blood albumin for this purpose is now almost entirely abandoned. The colourless liquids are then evaporated *in vacuo* until of sufficient density to crystallize. The operation of making the different sizes of crystals is performed in the vacuum pan, the large crystals being the result of large and heavy charges of syrup at long intervals, so that the crystals can grow during boiling. Fine crystals, on the other hand, result from frequent and light charges. The preparation of Demeraras involves the addition of small quantities of sulphuric acid to the charge in the pan just before the "massecuite" is grained and ready to run out. This results in a small quantity of the sugar being converted into a slightly caramelized form, thus imparting the fine golden yellow tint so much sought after in sugars of this class. This blooming is also assisted very frequently by the addition of small amounts of chloride of tin, but usually this is only done in inferior sugars. The finest Demeraras owe their brilliancy to care in clarification and defecation.

Sugar-refining.

Very frequently in recent years it has been found that so-called Demeraras are ordinary colourless sugar stained with aniline dyes. They are really beet sugars which have been put forward as substitutes for genuine Demeraras. They are usually sold now under the name of *Yellow Crystals*. Such sugars may be detected

Rough Test for Yellow Crystals.

by examining with a pocket lens, when the crystals will be seen to be unequally coloured. Dilute acid will often turn such sugars pink or red, whilst absolute alcohol will abstract the dye and leave the sugar colourless.

Loaf and Cube Sugars.

Loaf and cube sugar, with their derivatives, castor, granulated, and icing sugars, are the purest food materials found in commerce, consisting as they do of 99·8 per cent pure sucrose. The refining of these sugars is precisely similar to that mentioned already, but no acid is added on evaporation. Loaves are made by running the syrup in the condition of "massecuite" into iron frames of conical shape, having a hole in the tip for syrup to drain away. When the first charge has cooled and drained, fresh quantities of syrup are poured on and allowed to percolate through the mass until a solid block is obtained, by which means the colour becomes whiter and the loaf more solid and dense. When sufficiently solid the loaves are removed from the moulds and placed in hot rooms to dry. *Sugar candy* is made by slowly crystallizing purified sugar upon lengths of string suspended in the concentrated syrup. By this means large bunches of crystals are obtained. It is made in both white and yellow form. *Cube sugar* was originally obtained from the sugar loaf by cutting it with a pair of scissors or nippers. It is now, however, made at the refineries by various ingenious machines which mould the cubes upon the surface of a cylinder. Other methods consist in crystallizing the sugar in flat slabs, and cutting with a series of saw blades, or sheets of cutters arranged to work in a machine.

Granulated Sugar.

Granulated is fast becoming one of the most popular types of sugar in commerce. It is made by boiling the syrup to the "massecuite" stage, until it has a sharp grain. The syrup is run out; the sugar is then freed from syrup in the centrifugal, and afterwards washed to clean the crystals. The wet crystals are then fed into a granulator, which generally consists of a long revolving cylinder. The crystals pass through this cylinder and are subjected to heat, so that they become dried. The dry crystals then pass into an elevator, and are conveyed into a dressing machine which sorts the crystals into the various grades according to size. The largest of these crystals are called *coffee crystals*, the medium-sized ones are the ordinary *granulated*, and the smallest are *castor sugars*. *Icing sugar* is prepared by grinding the cube, granulated, or waste pieces from the manufacture of these varieties in disintegrators, and passing the product through dressing reels. Several different grades are thus obtained, which are used chiefly in biscuit manufacture, confectionery, and pharmacy.

Pieces Sugar.

Pieces is a soft sugar having little or no grain, usually obtained from beet-sugar refining. The syrups from which first and second crystals have been obtained are boiled to a jelly, and allowed to stand two or three days in order to crystallize. The mass is then centrifugalized to separate the remaining syrup, and the crude sugar obtained is known as *First Pieces*. The syrup residues are again treated in a similar manner, when they yield an inferior grade called *Second Pieces*.

Pieces usually have an unpleasant odour, and a slightly acrid flavour due to the large amounts of saline impurity in them. Their chief use is in biscuit and confectionery manufacture.

The best white sugars are usually dressed with a little ultramarine blue in order to destroy any faint trace of yellowness. In order to test a white sugar for ultramarine, dissolve several ounces of the sugar in water, and allow to stand until the colouring matter has settled; decant off the liquid, and wash the residue with water. On treating the residue with hydrochloric acid the blue colour is destroyed if it is ultramarine.

Test for Ultramarine Colouring.

As in crude sugar-making, so also in refining, a residue of syrup is obtained which does not crystallize, owing partly to impurities and saline matters, and partly to the presence of non-crystalline sugars. As, however, these syrups may contain as much as 50 per cent sucrose, they undoubtedly form valuable sweetening agents. By means of certain complex processes much of this sugar could be recovered, but in the case of cane-sugar syrups this practice is seldom resorted to, the syrup being sold under the name of *golden syrup*, for which there is a considerable demand. The syrups obtained from beet-sugar refining, however, are unfit for human consumption by reason of their nauseous flavour, which is due to the large amount of saline impurities they contain. Such syrups are now largely utilized in preparing certain well-known cattle foods. Golden syrup contains much invert sugar as a result of the frequent boilings to which the sucrose has been subjected. In addition to this, however, some manufacturers have adopted the practice of adding a small proportion of glucose, with the object, it is said, of preventing graining, *i.e.* crystallization of the syrup. Such syrups should be sold with a declaration of the addition upon them, for proceedings have several times been taken under the Food and Drugs Act for passing such mixtures as pure golden syrup.

Golden Syrup.

Good cane sugar should be perfectly soluble in half its weight of cold water, and the solution should be free from dirt and other impurities which would yield a deposit on standing. This forms a rough-and-ready test for buying sugars. On boiling a solution of sugar at atmospheric pressure water is given off; but, unlike most liquids, the temperature does not remain constant until all the water is driven off. As boiling proceeds, the temperature slowly rises and the mass becomes faintly acid, and invert sugar is gradually formed, so that the power of crystallizing on cooling again is lost entirely.

Testing Sugars.

When heated to 160° C. (320° F.) crystallized sugar melts, and, on cooling again, yields a golden-yellow solid of a glassy nature called *barley sugar*. If the heating is carried above 160° C., the sugar undergoes considerable chemical modification and parts with some of its water of constitution, being converted into non-saccharine bodies at 190° C. (374° F.). It gradually darkens, and forms the body known as *caramel*. This caramel is marketed in the form of a dark-brown

Barley Sugar.

viscous liquid, or as a vitreous solid. Its solution in water is used for colouring rum, brandy, whisky, vinegar, fruit essences, and many articles of confectionery and cookery. During the boiling of a watery solution of sugar, products having different physical properties are obtained according to the degree of temperature to which the boiling is allowed to proceed. The sugar-boiler recognizes some nine or ten of these stages between the temperatures of 220° F. and 350° F. These stages he usually recognizes by certain practical tests, and but seldom boils by the thermometer. The various products are utilized in the making of soft and hard fondants and ball or stick toffees.[1]

Cane sugar has no reducing action upon Fehling's solution or ammoniacal silver nitrate solution. Dilute acids convert cane sugar into invert sugar, a mixture of dextrose and levulose, and then the solution reduces Fehling's solution and ammoniacal silver nitrate. Cane sugar possesses the power of rotating the plane of polarized light, and this is made use of in the testing of sugar for purity. Its specific optical rotation is $[\alpha]_d + 66{\cdot}5°$ for 10-per-cent solutions. This specific rotatory power is defined as the angle through which a ray of polarized light is rotated when it traverses a column 1000 mm. in length of a solution containing 10 gm. of the substance in 100 c.c. Since the rotation varies directly with the concentration of the solution it is possible, when the substance and its specific rotation are known, to ascertain the percentage in any solution by means of the polarimeter. When treated with alkalies, sugar becomes of a dark-brown colour on heating, and is gradually decomposed. This browning can be seen in scones and other goods made with excess of soda.

The strength of cane sugar solutions or syrups may be determined with fair accuracy by means of the specific gravity of the solution. Hydrometers are made expressly for gauging sugar solutions, and in those of Balling and Brix the percentage of sugar is marked in degrees upon the stem for every increase in specific gravity. In the absence of these specially marked instruments an ordinary hydrometer giving specific gravities may be used, or the specific gravity may be determined by means of the bottle or picnometer. It has been carefully determined that the addition of 1 gm. of cane sugar to a solution of 100 c.c. raises its specific gravity by 3·86, and this is approximately true throughout a long range. It follows, therefore, that by a reversal of reasoning we can find the weight of sugar in solution if its specific gravity is known. This is done by subtracting 1000 from the observed specific gravity × 1000, and dividing the remainder by 3·86. This gives the weight of sugar present in a given volume of the solution. For example, suppose the observed gravity is 1·050, then

Test for Sugar Strength.

$$\text{Weight of solids} = \frac{1050 - 1000}{3{\cdot}86} = 12{\cdot}95 \text{ gm. in 100 c.c.}$$

This method may also be applied to all the other sugars in solution.

[1] See Chapters on Sugar Boiling in a later volume.

Proximate Composition of Sugars.

The following table of analyses by many authorities shows the average composition of the various types of sugar:—

	Sucrose or Di-saccharides.	Glucose or Mono-saccharides.	Ash.	Non-sugars.	Water.
Raw Cane Sugars—					
West India ...	94·4	2·2	0·2	0·3	2·8
Dominica	88·3	3·36	1·22	2·17	4·9
Jamaica	90·4	3·47	0·36	1·55	4·2
Porto Rico ...	87·5	4·84	0·81	2·60	4·2
Trinidad	88·0	5·14	0·96	1·67	4·2
Surinam	86·8	4·31	2·28	5·34	5·27
China	72·5	9·19	1·80	9·75	6·76
Benares	94·5	2·63	1·50	0·39	0·98
Jaggery	75·0	11·00	2·0	4·00	8·00
Manilla	87·0	5·50	1·25	2·50	4·00
Raw Beet Sugars—					
Average	93·64	trace	1·67	2·07	2·62
Beet, firsts ...	95·0	0·00	1·25	1·75	2·00
Beet, seconds ...	91·0	0·25	2·50	3·25	3·00
Refined Sugars—					
Tate's crystals ...	99·20	0·00	trace	trace	trace
French pulverized	99·70	trace	0·10	0·00	0·20
Duncan's granulated	99·80	trace	0·10	none	0·10
Martineau's tablets	99·80	none	0·10	none	0·10
Friezel's crystals ...	99·86	none	0·01	none	0·13
White coffee crystals	91·00	2·40	0·30	0·80	5·50
Beet loaf-sugar ...	99·10	trace	0·15	none	0·25
Yellow sugar, XC	87·0	4·50	1·00	1·50	6·00
Yellow sugar ...	82·0	7·50	2·00	2·50	6·00

CHAPTER XLVI

SUGARS AND SACCHARINE MATERIALS: OTHER SUGARS AND SUGAR SUBSTITUTES

Other Disaccharide Sugars

Sorghum.

Sorghum (*Andropogon Sorghum*, var. *saccharatus*) is a grass which grows largely in America, some varieties containing as much as 8 per cent of sugar. Though at present it is not of much account in the production of sugar, yet during recent years its cultivation has greatly extended under the assistance of the U.S. Board of Agriculture.

The chief difficulty in the manufacture of sugar from it arises from the presence of starch in the grass.

Maple Sugar, prepared from the sugar maple (*Acer saccharinum*), a tree of eastern North America, is a special variety of sucrose very highly prized on account of its peculiar flavour. Its production is almost exclusively confined to Canada and one or two states in U.S.A. The maples are tapped, and the juice which is collected is boiled down in open pans to a proper consistency. The scum is removed very carefully, since its retention would be likely to give rise to fermentation in the finished sugar. It is estimated that each tree yields an average of 4 lb. of sugar per annum. Maple sugar is never refined, since its chief value depends upon the impurities, its flavour being due to small quantities of ethereal substances. Maple sugar is slightly laxative in its effects. The following analyses are given by Leach:— **Maple Sugar.**

Sucrose	71·80 to 86·89
Glucose	traces „ 12·19
Water	6·77 „ 11·57
Ash	0·31 „ 1·50

Maple sugar is frequently adulterated with molasses or brown cane sugars, and inferior maple sugars are fortified with syrup or commercial glucose. These adulterants are usually capable of detection by the flavour they impart.

Maltose or *Malt Sugar* ($C_{12}H_{22}O_{11}$) seldom comes into market in the pure state. It is, however, the principal sugar occurring in malt extracts, and is produced in all cases where diastase acts upon starch. It also occurs in glucose syrup, since the action of dilute acids on starch results in its formation, together with other bodies. The formula representing its production by the action of malt diastase upon starch is given in the following equation:— **Malt Sugar.**

$$\underset{\text{Starch.}}{5C_{12}H_{20}O_{10}} + \underset{\text{Water.}}{4H_2O} = \underset{\text{Maltose.}}{4C_{12}H_{22}O_{11}} + \underset{\text{Dextrin.}}{2C_6H_{10}O_5}$$

This change takes place under the best conditions at 60°–65° C. (140°–149° F.). The sugar may be separated from the other products of the reaction by treatment of the solution with strong alcohol, which precipitates the dextrin, and the sugar can be crystallized by evaporation of the solvent. Maltose is less sweet than cane sugar. It is also less soluble both in water and alcohol. It rotates the plane of polarized light to the right, its specific rotatory activity being $[a]_d = +139°$. Maltose crystallizes in tiny needles or warty masses with one molecule of water, which is expelled at 100° C. (212° F.), the resulting sugar being then extremely hygroscopic. Dilute acids and certain ferments convert maltose into dextrose. Yeast does not directly ferment maltose, but it secretes a ferment which quickly converts it into glucose, and it then becomes fermentable. Maltose reduces Fehling's solution.

Lactose, Milk Sugar ($C_{12}H_{22}O_{11}$), is the sugar present in milk. Practically the whole available supply is prepared from cows' milk by separating the cream and precipitating the casein with rennet. The whey is then evaporated and the lactose crystallizes in hard, semi-transparent prisms containing one molecule of water. By treatment with animal charcoal and recrystallization the sugar is finally obtained perfectly pure. The polarizing power of lactose is $[a]_d = +52{\cdot}5°$. On heating lactose to 130° C. (266° F.) it gives up its water of crystallization, and at 180° C. (356° F.) it becomes converted into lactose caramel. As previously mentioned, lactose is not fermentable by yeast under ordinary circumstances, but in contact with decomposing proteins it undergoes splitting, and then fermentation results, with production of alcohol and lactic acid.[1] Certain yeasts appear to be capable of carrying out this transformation of lactose, and these occur in the fermented beverages made from milk in Russia, &c., *e.g.* koumiss and kephir. When boiled with dilute acid lactose is converted into a monosaccharide and a disaccharide, viz. dextrose and galactose. Lactose reduces Fehling's solution and ammoniacal silver nitrate without previous inversion. Lactose is not quite so sweet as maltose, producing a somewhat gritty sensation in the mouth.

Milk Sugar.

Glucose and Levulose

Glucose, Dextrose, or *Starch Sugar* ($C_6H_{12}O_6$), is the chief member of the monosaccharides occurring in commerce. It never comes into the market in a pure state, being always associated with dextrin, which is produced at the same time. Starch is converted by the action of dilute acids into dextrose, maltose, and dextrin; the resulting liquors are treated with chalk to neutralize the acid, filtered and evaporated to a thick syrup, or concentrated so that on cooling the mass solidifies. Dextrose is the chief sugar present in ripe grapes. It crystallizes in warty masses, containing one molecule of water. Dextrose melts at 146° C. (295° F.), and at 170° C. (338° F.) loses water, and is converted into glucosan, $C_6H_{10}O_5$, and at higher temperatures into caramel. The specific rotation of dextrose is $[a]_d = +52{\cdot}7°$. Alkalies turn dextrose dark brown in colour, and prolonged treatment with acids converts it into non-saccharine substances. Dextrose is not very sweet to the taste. It enters readily into fermentation with yeast, and reduces Fehling's solution and ammoniacal silver nitrate solutions.

Starch Sugar.

Glucose is principally made from cheap starchy materials, *e.g.* maize in America, and potatoes in France and Germany. It occurs in two forms, liquid and solid. Liquid glucose is a colourless syrup, containing from 12 to 14 per cent of moisture. Solid glucose generally occurs in large cheesy lumps or chips having a pearly lustre. The principal impurity which glucose is liable to contain is arsenic, which may be derived from the acid

[1] This condition never arises practically in bread fermentation.

used for converting the starch. The following analyses show the variable composition of these products:—

	Liquid Glucose.	Solid Glucose.
Dextrin	29·8 to 45·3	0·0 to 9·1
Maltose	4·6 „ 19·3	0·0 „ 1·8
Dextrose	34·3 „ 36·5	72·0 „ 99·4
Ash	0·3 „ 0·5	0·3 „ 0·75
Water	14·2 „ 17·2	0·6 „ 17·5

Glucose, when care is taken in manufacture to ensure the absence of arsenic, is a perfectly healthful and pleasant product, enabling the confectioner to obtain results which cannot readily be otherwise produced. Its much lower sweetening properties than cane sugar also enable it to be used in relatively large amount without producing sickliness. Glucose is the principal material used in the production of caramel.

Levulose is the sugar occurring in flowers and in some fruits. It is also produced in equal quantity with dextrose upon inverting cane sugar by acids or ferments. It is difficultly crystallizable, and usually occurs in commerce in the form of a brown syrup. It is probably quite as sweet as cane sugar. It is chiefly remarkable in polarizing in the opposite direction to all the other sugars, and hence its name of *left-handed sugar*. Its rotatory power is $[a]_d = -98{\cdot}8°$. Levulose reduces Fehling's solution and also ammoniacal silver nitrate.

Levulose.

Honey consists of about equal parts of dextrose and levulose. It is obtained chiefly by bees from the nectaries of various flowers. During its stay in the body of the bee the sucrose, which is the chief sugar abstracted, becomes inverted into dextrose and levulose. The flavour of honey varies greatly, according to its source. In addition to sugars, honey contains small amounts of mineral matter, pollen, wax, and certain acids, chiefly formic acid. The following analyses of pure and adulterated honeys show the general composition of these products:—

Composition of Honey.

	Pure Honey.	Honey adulterated with Cane Sugar.	Honey adulterated with Glucose.
Sucrose	0·5 to 7·6	43·1 to 17·0	8·8 to 0·0
Invert sugar (*e.g.* dextrose and levulose)	60·3 „ 78·8	42·4 „ 67·2	46·1 „ 49·8
Ash	0·03 „ 0·5	— „ 0·06	0·03 „ —
Water	12·0 „ 33·0	42·4 „ 15·5	15·1 „ 23·7

Honey is often grossly adulterated with glucose or cane-sugar syrups, and though such mixtures are quite harmless, and probably quite as nutritive as pure honey, they should not be sold at the price of genuine honey, because they are so much more cheaply produced.

Other Sweetening Substances

Glycerin, $C_3H_5(OH)_3$, is perhaps the only natural sweetening agent which is *not* a sugar or even a carbohydrate. It is in reality an alcohol belonging to the fatty hydrocarbons. It exists naturally in large quantity in all fats, where it is combined with various acids, forming ethereal salts (see Chap. XLII, p. 247). Pure glycerin is obtained from fats by hydrolysing them with steam under pressure. As ordinarily obtained it is a colourless thick syrup, of specific gravity 1·26, and looking very like glucose syrup. It boils at 290° C. (554° F.), but usually decomposes owing to the presence of impurities. Glycerin has great affinity for water, which it rapidly absorbs from the air. It has a distinctly sweet taste, but produces a slightly rough, drying feeling in the mouth. On account of its hygroscopic properties glycerin is frequently used in bread and cake making in order to assist the moist-keeping qualities of the products. It is also much used in diabetic cookery as a sweetening agent, where it can be safely used instead of sugar. Glycerin is somewhat liable to be contaminated with lead and arsenic, impurities which are derived from the reagents and vessels employed in its manufacture. The most highly refined glycerins, as prepared for medicinal purposes, are usually perfectly free from these poisons, and may be safely employed in the preparation of foods.

Glycerin.

During recent years certain purely artificial products have been discovered which possess sweetening properties far in excess of any sugar hitherto known. These bodies, which are obtained from coal-tar products, find an application in the preparation of foods for diabetic and gouty patients, and are also used to a large extent in the manufacture of mineral waters and some preserves. These substances have no food value whatever, but from their powerful nature they can be used in very minute quantity and still impart a considerable sensation of sweetness to the articles they are blended into. Their use is likely to be strongly objected to by health authorities, except in certain well-defined cases.

Artificial Sweetening Substances.

Saccharin or *Benzoyl Sulphimide* ($C_6H_4CO \cdot SO_2NH$) is the best known of these sweeteners. It is a white powder having a melting point of 224° C. (435° F.). It is soluble in about 230 parts of cold water. In sweetening power it is 300 to 500 times as strong as cane sugar, and the addition of 1 part saccharin per 1000 parts of commercial glucose renders this syrup as sweet as cane sugar. Saccharin is prepared from the hydrocarbon toluene by treatment with concentrated sulphuric acid. The sulphonic acids thus formed are next converted into chlorides, one of which, the ortho salt, upon interaction with ammonia, yields the imide. A sodium salt of saccharin has been put upon the market. It is more soluble in water than the pure saccharin, and at the same time possesses about equal sweetening properties. Saccharin is largely administered in the form of tablets.

Saccharin.

In addition to its sweet taste saccharin possesses positive antiseptic properties, and consequently may be considered as a preservative. It certainly has a retarding action upon the digestion by virtue of these properties. According to Squibb, saccharin has anti-ferment action equal in intensity to boric acid. It should therefore never be used in infant or invalid preparations without disclosure of the fact. When saccharin is fused with an alkali and potassium nitrate, the sulphur in it is oxidized to sulphuric acid. Upon dissolving the mass in water and adding barium chloride, the presence of the sulphuric acid becomes apparent. In this way saccharin may be detected, and, if necessary, quantitatively determined.

Action of Saccharin on Enzymes and Ferments.

Dulcin, Sucrol, or *Paraphenetol Carbamide* ($C_2H_5O.C_6H_4.NH.CO.NH_2$), is a white powder sparingly soluble in cold water. It is soluble in 800 parts cold and 50 parts boiling water, whilst 25 parts of 95-per-cent alcohol also dissolve it. It is about 400 times sweeter than cane sugar. It melts at 173° C. (343° F.), and decomposes when strongly heated.

Dulcin.

Glucin is a light-brown powder readily soluble in water. It decomposes without melting at 250° C. (482° F.). It has 300 times the sweetening power of cane sugar. If glucin is dissolved in dilute hydrochloric acid, and the cooled solution is treated with sodium nitrite solution, a few drops of alkaline β naphthol produces a red coloration which may be considered characteristic of glucin. These bodies, however, are used to a much smaller extent than saccharin.

Glucin.

CHAPTER XLVII

EGGS

Eggs constitute one of the most important of the raw materials used in confectionery, entering as they do more or less largely into the great majority of the articles made, and in many cases being the indispensable ingredient without which certain goods cannot be made. The confectioner relies upon his eggs to perform two important functions. By reason of the property they possess of film formation, thereby occluding large amounts of air, they act as an excellent aerating agent which can be used in rich mixings where both yeast and chemicals are inadmissible. Their chemical composition is such that they greatly enrich all other materials with which they are blended, the improvement effected not being limited merely to an increased food value, but extending to better appearance, colour, and flavour, qualities which the confectioner is compelled to regard as of paramount importance in the productions of his handicraft.

Eggs as Aerating Agents.

The eggs of many kinds of birds are used as food in different parts of the world, but by far the most widely employed in cookery are the common

hen's egg, and to a much smaller extent the duck's egg, whilst goose and turkey eggs are rarely used except in domestic cookery. Generally speaking, it may be stated that the eggs of all birds are closely similar in chemical composition, though they differ markedly in weight and also in flavour. The hen's egg has been the most completely investigated at present, and will here be taken as typical of eggs in general. An egg

Chemical Composition of Eggs.

contains in primitive form all the necessary materials requisite to form blood, bone, muscle, and indeed all the tissues of the young chick. It follows, therefore, that the chemical nature of the chief constituents must be nitrogenous in character, consisting of bodies called proteins by the chemist. In addition there must be a large supply of mineral matter for bone formation, and fats to supply heat. On the other hand, the carbohydrates, *e.g.* starch, sugars, &c., are not required, since such bodies act mainly as heat producers and require oxidation. As no active life is possible within the shell, this group of substances is hardly

Proportions of Parts of Eggs.

represented at all. For the purpose of considering its practical value, an egg may be conveniently divided into three parts: (1) the envelope or shell; (2) the almost colourless slightly jelly-like albumin layer or *white*; (3) the globular deep-yellow coloured *yolk*. In hens' eggs these parts bear about the following proportions to each other:—

	Parts per 100.	In One.
Shell	... 10	5 gram.
White	... 59	33 „
Yolk	... 31	18 „

Average hen eggs weigh 2 oz. (56 gm.), duck eggs 2½ oz. (70 gm.), goose eggs 5 to 6 oz. (160 gm.), and turkey eggs 4 oz. (110 gm.) each. The best hen eggs are those which weigh about 8 to 10 to the pound. When smaller the whites are usually weak, and the loss due to excessive proportion of shell makes such eggs more expensive than the larger and higher-priced ones.

The shell of an egg consists chiefly of carbonates and phosphates of calcium and magnesium deposited upon a thin tough membrane which encloses the liquid portion. It is very porous, and consequently permits free passage of air and the various impurities suspended in it. In course of time this brings about evaporation of moisture and gradual shrinkage of the egg mass, and eventually results in setting up decomposition of the chemical compounds present. The various methods of preserving eggs, therefore, have for their object the closing of these pores in the shell, thus effectually preventing decomposition.

The classical method for detecting stale eggs consists in holding the egg between the eye and a bright light. The egg is fresh if it appears

To Detect Age of Eggs.

perfectly clear and transparent, with only a faint indication of the air chamber at one end. If it is not fresh, a more or less cloudy appearance will be observed, and in extremely old eggs the whole mass is opaque. Another method by which it is stated the age of

an egg can be approximately determined consists in placing the egg in a 10-per-cent solution of common salt. Should it sink and rest upon the bottom it may be regarded as perfectly fresh; if it is about three days old it will remain suspended in the liquid; but if it floats upon the surface it is at least five days old. This method is not applicable to eggs which have been preserved by methods which will be referred to shortly. The following mean composition of hens' eggs is given by König:—

	Water.	Protein.	Fat.	Non-nitrogenous Substances.	Salts.	In the Dry Substance.	
						Nitrogen. Per Cent.	Fat. Per Cent.
Whole egg ...	73·67	12·55	12·11	0·55	1·12	7·66	45·99
White ...	85·75	12·67	0·25	—	0·59	14·25	1·78
Yolk... ...	50·79	16·24	31·75	0·13	1·09	5·30	64·43

Although composed almost entirely of fats and proteins, it must not be concluded that the constitution of eggs is therefore simple. On the contrary, it is of the highest complexity, the white being made up of many different proteins, and the yolk containing many complex combinations of fat with proteins, forming highly elaborated structures, many of which are as yet only partially understood. An egg must be regarded as a congeries of individual cells.

White of Egg.

Egg white, or the albuminous part of an egg, is the portion out of which the several tissues of the chick are formed. It is a transparent faintly yellow-coloured ropy fluid, having a weak alkaline reaction. The more jelly-like the white the better it is for confectioners' purposes. It consists physically of two parts, being essentially a thin fluid enclosed in a framework of firm fibrous material, which forms a cellular membrane throughout the mass. The fluid portion is really very liquid, but the presence of the membranous envelopes gives it a high viscosity. The membrane is insoluble in water and in dilute salt and acetic acid solutions. If whites of egg are thoroughly beaten up in water the albumin passes into solution, and the insoluble membrane can then be filtered off. The presence of this membrane in white of egg is of the greatest importance to the confectioner, since it provides the fibrous structure around which the viscous protein solution can form thin walls, thus converting the mass into millions of air-cells when the whites are beaten or whisked. Good whites can be readily beaten into a perfectly stiff froth, but this cannot be accomplished if even small traces of yolk are included or if grease of any kind is present. Anything which tends to reduce or destroy the viscosity of the fluid, such as dilution or addition of oily substances, renders the production of this froth an impossibility, because under these conditions the films stretching between the fibrous structure become broken as fast as they are formed. Sugar has the opposite effect, aiding

Action of Fats and Sugar on Egg Whites.

the formation to some extent, because, by forming a syrup with some of the water present, it increases the viscosity slightly, and thus contributes to the stability and permanency of the film when it has formed.

Weak Eggs. Eggs which are technically known as "weak" owe their inferiority to a deficiency in the amount of the membranous portion of the whites. It may be overcome to a considerable extent by exposing the broken eggs in a dry airy place for a few hours before whisking. By this means some of the water is evaporated from the fluid portion and its viscosity is increased, and, at the same time, the relative proportion of membrane to fluid is also slightly raised, so that the frothing can be better accomplished. The custom of adding small traces of acetic acid and cream of tartar also possibly slightly increases the power of frothing by converting some of the albumen into acid albumen.

White of egg has a specific gravity of 1·045, and by evaporation at temperatures not exceeding 60° C. (140° F.) it yields from 12 to 13 per cent by weight of solid substance of a yellowish horny character. The salts present in white of egg are mainly sodium chloride and sodium carbonate, and it is this latter salt which imparts the alkaline reaction to whites. When heated with water to a little above 60° C. (140° F.) egg albumin gradually becomes cloudy, forming small flocks; if the temperature is increased to 72° C. (161° F.) it becomes quite insoluble, forming a dense white, opaque, jelly-like solid, which cannot be dissolved again in water. It is soluble in dilute acetic acid or in solutions containing pepsin, but with alteration of its properties. Very dilute acids do not cause precipitation of egg albumin, but strong acids cause it to coagulate.

Yolk of Egg. Yolk of egg is the stored nutriment designed to serve for the support of the young chick during the period of development within the shell; consequently it has a composition wholly different from that of whites. It may be looked upon as the part corresponding to the endosperm in the cereals. Yolk contains a larger proportion of solids than whites, but the predominating constituent is fat. Egg yolk is a thick, yellow, opaque fluid of an oily nature. It is composed of a larger number of substances than whites, the chief constituents being the fats, olein, palmitin, and stearin, which are identical with the principal fats occurring in the animal body, and the proteins, nuclein and vitellin, with certain highly complex phosphorized fatty proteins, among which lecithin may be noted. The colouring matter is called lutein, and contains iron in an organic form. To this body the fine tinctorial property of eggs is due.

The principal protein in yolk is vitellin, which is insoluble in water but soluble in saline solutions. It differs considerably from the proteins of whites. The coagulation of yolk by heat takes place at a higher temperature than that of whites. Yolks cannot be beaten into a stiff froth like whites, though by whisking a certain amount of air can be incorporated. This is the result of the operation of several causes, among

which may be noted the different character of the proteins, albumin being present in very small quantity, the absence of a fibrous structure around which cells can be formed, and the presence of relatively large quantities of fatty matter.

The yolk, however, yields by far the most valued of the food constituents in eggs, namely, the fats and phosphorized compounds, whilst the rich colouring and flavouring properties render it indispensable to the confectioner.

It has already been noted that the porous character of the shells is the cause of the speedy deterioration of eggs which are kept for any time after laying. When first laid an egg is coated with a natural preservative in the shape of a thin layer of mucilage, but this is speedily removed by handling or washing. The preservation of eggs has been a problem of great practical importance for many years, and a large number of methods have been proposed to attain this end. The earlier processes simply consisted in packing the eggs in some loose absorbent material, such as bran, salt, charcoal powder, so as to fill up all spaces between the eggs and exclude air as far as possible. Thus treated, eggs keep much longer than would be the case if air had free access, but the method is not satisfactory for any long period. Other methods, employed with more or less success, involved the coating of the shell with some impervious material, such as butter, vaseline, gelatine, or varnish. Solutions of common salt and lime water yield very good results, the eggs being packed into jars or tubs and covered with the solution. In a series of tests made in France with a large variety of methods, it was found that the use of lime water was among the three best processes, there being no failures with it during the period of the test.

Methods of Preserving Eggs.

Undoubtedly the best practical solution for egg preservation is sodium silicate or water glass. In 1893 Bourne took out a patent in France for the use of silicate of soda, the egg being dipped into the solution and then removed and allowed to dry. This is not a perfectly satisfactory method of applying the preservative, and although somewhat more cumbrous, and necessitating the use of large receptacles where any number of eggs are to be laid by, there can be no doubt that the permanent immersion of the eggs in a dilute solution of the reagent is by far the safest process. The eggs should be packed into stoneware jars in the unwashed condition; a solution of water glass of 10 per cent strength (obtainable at any chemical dealer's or drysalter's) is then poured upon them, so as completely to cover them over. Thus treated, eggs may be preserved for six to eight months easily. The chief drawback of the process is that the shells become very brittle, but this is not of great importance to the confectioner. The danger of weakening the whites by transfusion of water through the shell is not nearly so great with water glass as with other liquid solutions. Cadet de Vaux proposed to plunge the eggs into boiling water momentarily, and thus form

Water Glass.

a thin skin of coagulated albumin on the interior wall of the shell. This would form an impervious coat and protect the rest of the egg. Various forms of preserved eggs are now placed upon the market, and there is really little difficulty attending their production.

Dried Eggs.

Desiccated eggs, both mixed or whites and yolks separated, are readily obtained by evaporation in the open air at low temperatures, if the material is first thoroughly broken up by beating. The temperature of evaporation should not exceed 45° C. (113° F.). Whites so dried yield a horny solid easily powdered. The powder, which is of a greyish tinge, keeps well for unlimited periods. It dissolves rather slowly in cold water when required for use. Yolks dry quite as easily, but owing to their fatty nature they cannot readily be reduced to fine powder. Dried yolk forms large yellow granules of a soft cheesy nature. Kept in a closed receptacle they acquire a faint odour, but do not go bad if properly dried. They may be kept two or three years. Recent improvements in drying eggs consist in emulsifying the egg with water to break it up into a fine homogeneous state, the mass being treated usually with a small amount of sodium bicarbonate to facilitate resolution of the dried powder. The emulsion is then sprayed upon heated revolving cylinders, which cause the water to be quickly evaporated, and the dried egg forms a thin skin upon the surface of the drum, from which it is removed by means of a knife held with its edge against the face of the cylinder. This method is similar to that employed in drying milk.

The following analyses of two samples of dried eggs obtained in America are given by Leach:—

Composition of Dried Eggs.

	Sample A.	Sample B.
Water	6·80	5·95
Proteins (N × 6·25) ...	45·20	48·15
Protein by difference ...	51·20	—
Fats	38·50	40·56
Ash	3·50	5·34

These were undoubtedly genuine dried egg powders. An attempt was made a few years ago to put upon the market eggs preserved in syrup.

Eggs preserved in Syrup.

The eggs were homogenized so as to form a liquid, and glucose syrup added to form a preservative. The fluid was then packed in hermetically sealed tins, similar to those used for condensed milk. A sample of this product which came into the author's hands yielded the following analysis:—

	Per Cent.
Water	35·29
Fats	11·89
Proteids (N × 6·33)	14·03
Glucose	32·52
Ash	0·94
Unestimated	5·33
	100·00

The mixture kept good for about two months when exposed to air, after which it slowly became mouldy. The large quantity of glucose is the chief objection to its use as a substitute for fresh eggs in confectionery manufacture. The use of a definite quantity of sugar to mix with eggs left over on any day will keep them sound for use for several days, the sugar thus added to them being allowed for in the mixing in which they are ultimately used

To Keep Eggs Left Over.

CHAPTER XLVIII

EGG SUBSTITUTES

Many powders have been put forward from time to time for the purpose of substituting eggs. Some of these substances contain considerable amounts of nitrogenous matter, being prepared from gelatin, gum, blood albumin, or casein. They are generally sold in the trade under fancy names, and occur in the form of white or greyish powders. The so-called egg powders sold to the public usually bear no resemblance to eggs except in colour. They are mainly starch, with the addition of a chemical aerating agent, such as cream of tartar and sodium bicarbonate, coloured brilliantly with turmeric or some coal-tar dye. All the principal proprietary egg powders are of such composition, and it is needless to remark that they cannot properly fulfil the functions performed by eggs. Of the albuminous powders already referred to, it may be said that such substances will yield a very good froth when whipped up with small amounts of water. They cannot, however, be brought to the same degree of stiffness as white of eggs, and when articles made with them are brought into the oven they fail to expand, the air-cells tending to burst, or the whole mass may sink down again after having risen. The reasons for the failure of these substances must be sought partly in their chemical and partly in their physical nature, for whilst they all possess considerable viscosity, none has the elasticity which egg albumin is found to have.

Egg Powders.

Blood albumin is the substitute bearing the closest chemical resemblance to egg albumin. It is obtained from the watery serum of blood after the clot consisting of fibrin and corpuscles has been removed. The commercial article is made in several qualities, the best refined being of a yellowish colour; the dark-coloured albumins have been imperfectly refined. It should be in thin layers or flakes, transparent, free from objectionable smell, and completely soluble in cold water when well stirred. It is liable to be adulterated with gum dextrin, sugar, casein, &c. Fish albumin is occasionally met with, but is easily recognizable by its odour. Blood albumin forms a good substitute for white of egg, but owing to the absence of fibrous membranes it does not yield so stiff and good a foam when whipped.

Commercial Albumen.

Gelatin is obtained from hoofs, horns, bones, hides, &c., by boiling with water or steaming. The liquor is strained, and skimmed, and concentrated, and then allowed to gelatinize in thin sheets by cooling. Pure gelatin is a white glassy solid, devoid of taste or smell. When heated it softens but does not melt. Placed in cold water it swells greatly, absorbing much water; it does not, however, dissolve to any extent, but upon warming to 30° C. (86° F.) it is dissolved completely. Upon cooling, solutions of gelatin set to a firm jelly. It will be seen from these properties that gelatin bears no resemblance to true albumins, for it is insoluble in cold water; nor does it set and become insoluble when heated to near the boiling-point of water. This great difference in properties renders gelatin quite unsuitable as a substitute for eggs in all goods requiring to be baked, though doubtless it is fairly efficient if required for preparing royal icing or ice cream. Meringues or macaroons made with gelatin cannot be obtained of any bulk, because the gelatin begins to soften and pass into solution just when it is required to coagulate and form an insoluble film. On boiling gelatin for long periods, or by repeatedly raising the temperature of gelatin to the boiling-point of water, its power of setting is completely destroyed. The suitability of a gelatin for food purposes is readily tested by pouring boiling water upon it and allowing it to stand for a short time. If the gelatin is pure the solution will remain unaltered in colour, and no unpleasant odour will be noted. The solution should be perfectly transparent and tasteless. A yellow colour or offensive odour shows the material to be unfit for culinary purposes. *Isinglass* is a variety of gelatin obtained from the swimming-bladder of the sturgeon and other fishes. It is sometimes adulterated with bone gelatin and other kinds of glue. On treating isinglass with hot water it swells to a whitish opal jelly and dissolves. On account of its greater solubility and inferior viscosity it is less suitable than gelatin as an aerating agent.

Gelatin.

Separated dried milk is the latest addition to the number of substitutes for eggs. It is a whitish flocculent powder, having a faint caseous odour. It is prepared from milk by separating the fats and then acidifying the solution with acetic acid. The precipitated casein is afterwards washed and dried. Casein solutions can be whipped, but do not yield a stiff or permanent froth. The froth possesses very little lifting power, though upon baking the casein films set to a horny insoluble condition. Casein is now used considerably in the manufacture of diabetic specialities. Bread and biscuits which are perfectly free from starch are made from it, and they are much more palatable than the gluten and bran products to which sufferers from this complaint were formerly confined.

Casein.

There does not appear to be any natural substance possessing quite the same physical properties as white of egg, though it is somewhat closely resembled by wheat gluten, with its insoluble glutenin, forming a framework upon which the slightly more soluble gliadin can form a film stretching between the fibrous net-work. In is this dual nature to which both materials owe their usefulness as aerators. *Separated gluten*

Separated Gluten.

now finds its way into the market in considerably larger quantity than formerly. It is generally obtained as a by-product from the manufacture of starch. Its chief present use is in the manufacture of diabetic bread and biscuits and other invalid food preparations, but it may at some future time become an egg substitute, since it certainly possesses aerating properties perhaps excelling eggs themselves.

CHAPTER XLIX

FLAVOURING SUBSTANCES: SPICES AND SEEDS

In order to impart to his products those delicate flavours and odours upon which their palatability very largely depends, the confectioner lays under contribution a great variety of substances, almost all of which are derived from vegetable sources. The appreciation of flavour is an idiosyncrasy not alone of individuals, but applying equally to nations, and consequently it will be found that the most incongruous substances have, at one time or another, been valued for their flavouring properties. To attempt even an enumeration of all the substances which have served this purpose in the past, or which may be in use at the present day, would be of no utility. Our attention will therefore be confined to short notices of the characters and properties of the materials having chief commercial importance, whilst special attention will be paid to those artificial substances which in some instances have almost displaced the natural products.

Spices

The principal flavouring substances are roughly divided into three groups:—1. Spices. 2. Aromatic seeds. 3. Essential oils and liqueurs. The spices are invariably used in the form of powder. They comprise almost every vegetable structure: fruits, flowers, buds, leaves, stems, barks, and roots. The reduction of many of these substances to a fine pulverulent form is a matter of considerable difficulty, necessitating heavy machinery, and they are consequently nearly always purchased from the merchant or spice-grinder in powder form.

Classification of Flavouring Agents.

Owing to their strong odour and flavour, spices are comparatively easily adulterated with worthless material, the high cost of the spice furnishing a powerful incentive to unscrupulous traders. The commonest form of adulteration consists in grinding along with the spice quantities of husks or shells. Among those so used cocoa-nut, Brazil nut, almond shells, olive and date stones, sawdust of various trees may be noted. Other adulterants are bran of different cereals, cotton-seed shells, and the hulls of peas, beans, and vetches. Although the addition of some of these substances may not be actually

Adulteration of Spices.

harmful, yet since it considerably reduces the flavouring power of the spice, it is a distinct monetary loss to the confectioner. The pungency of most spices is due to essential oils which they contain, and another form of sophistication consists in exhausting the spice with alcohol, thus extracting a considerable portion of the essential oils, and afterwards grinding the residual marc.

The recognition of foreign husks can be readily accomplished with the microscope, which is, indeed, indispensable for the examination of the powdered spices. It, however, necessitates considerable acquaintance with the microscopic appearance of the pure spices, if it is to be applied successfully. The detection of exhausted spice can usually only be accomplished by chemical methods, the best test being, perhaps, determinations of the ether extracts. The volatile ether extract gives the amount of essential oil, and the non-volatile indicates the amount of fixed or fatty oil.

Powdered spices require to be thoroughly blended into the flour before any other ingredients are added.

Ginger is the root-stock of the herb *Zingiber officinale*, a native of India and China, but now cultivated in America, Africa, and Australia. The root is dug up when the plant is one year old. Whole ginger appears in commerce in two forms. The most highly prized is *black ginger*, which is the root simply boiled immediately after digging, to prevent germination, and then dried. *White ginger* is the scraped or decorticated root, sometimes bleached or covered with carbonate of lime to impart greater whiteness. Black ginger has a greyish wrinkled skin with a brown under layer. The interior of the root is of a yellowish colour, horny and compact in structure. The dark epidermis contains a large amount of pungent resin, and this explains why its removal results in depreciation of value in the root. White ginger is usually sent to market in slightly longer pieces than the black variety, but owing to removal of the cortex the diameter is less than that of black ginger, whilst the aromatic properties are somewhat lower for the same reason. Ginger contains a greenish-yellow aromatic oil, the amount of which varies greatly in the different varieties of the root. Good ginger generally contains from 4 to 6 per cent.

Ginger.

The commonest form of sophistication consists in exhausting the root with alcohol, by which the flavour and pungency are greatly reduced. There appear to be two kinds of exhaustion practised, the first being by means of strong alcohol for the purpose of making essence or tincture of ginger, the other being by means of dilute alcohol or water, in the manufacture of ginger ale, &c. Exhausted ginger is seldom substituted alone, but is usually mixed with some whole ginger so that detection of the fraud may be made as difficult as possible. Other rare adulterations, which can only be made in ground ginger, are, the addition of turmeric, cereal starches, and sawdust; these are recognizable microscopically. The starch of ginger is of a characteristic ellipsoidal shape, and very transparent; the presence of foreign starch is therefore easy to recognize.

Exhausted Ginger.

Ginger Starch.

Preserved ginger is made by boiling the root in water and then placing in syrup.

Cinnamon.

True *cinnamon* is a native of Ceylon, and consists of the bark of a species of the laurel family, *Cinnamomum zeylanicum* (see Plate, SPICE PLANTS, No. 3). It has been highly prized as a spice from very ancient times. Crops are gathered in May and September, the two-year shoots being stripped of their bark. Cinnamon comes into the market in long cylinder-like rolls, having a pale yellow-brown colour, and slightly furrowed outer surfaces covered with dark spots. Cinnamon contains from ·5 to 1 per cent of a valuable essential oil, the characteristic properties of which are due to cinnamic aldehyde. This constituent, like all the aldehydes, acts as a powerful food preservative. On account of the very small yield of oil and the scarcity of the true bark real cinnamon oil is exceedingly expensive, averaging about 7*s.* 6*d.* per fluid oz. The oil is very pungent, and the odour persists for very long periods.

Cassia.

On account of its cost, cinnamon is largely substituted by *cassia*, the bark of *Cinnamomum Cassia*, indigenous in China and India. Cassia is comparatively abundant, and consequently much cheaper than true cinnamon. In appearance it is similar, but coarser in texture than true cinnamon. It is generally about four times as thick and of a darker colour. The wavy light-coloured lines on the exterior surface are also absent from cassia. The essential oil of cassia is similar to that occurring in cinnamon, but smaller in quantity and lacking in delicacy of flavour and aroma. Cassia buds are largely used in powdered cinnamon. They are the dried flowers of Chinese cassia.

Cloves.

Cloves consist of the dried flower buds of an evergreen belonging to the order of myrtles, *Eugenia caryophyllata* (see Plate, SPICE PLANTS, No. 1). The chief supplies come from Zanzibar and the West Indies. The buds are gathered as soon as they assume a reddish colour, and are spread out in the sun to dry, when the colour changes to a deep brown. Cloves possess a strong hot flavour, due to a volatile essential oil. The chief constituent of this oil is eugenol, an aldehyde which constitutes 70 per cent of the total oil. It is used as a basis for preparing artificial vanillin. The removal of the essential oil from the whole cloves is so easy that it is very frequently practised, and the exhausted cloves are afterwards sold, after being mixed in the proportion of about 10 to 25 per cent with fresh ones. The only method by which this fraud can be detected with certainty is by a chemical determination of the quantity of oil, the mean quantity being about 16 to 18 per cent. The ground spice is often adulterated with clove stems, whilst pimento is sometimes entirely or in part substituted for cloves. Pimento is about one-fifth the price of cloves, hence the inducement to use it. The structure of this spice precludes its substitution for whole cloves, and when it is used for adulterating ground cloves the microscope will reveal the fraud.

Adulteration of Ground Cloves.

Pimento, allspice, or *Jamaica pepper* is the dried fruit of *Pimento*

officinalis (see Plate, SPICE PLANTS, No. 5), an evergreen belonging to the myrtles, growing largely in Jamaica and India. The berry is grey to reddish-brown in colour, of a globular shape, with wrinkled skin. On breaking the berry open it is found to consist of two cells, each containing a small kidney-shaped seed. The berries are gathered just before they are ripe, as, if they are allowed to mature further, some of the aroma is lost. The oil obtained from pimento contains eugenol, but the total amount of oil only reaches some 4 per cent. On account of its cheapness the form which adulteration takes usually is the addition of ground cocoa-nut shells, olive stones, or exhausted ginger.

Pimento.

Nutmegs and *mace* are different portions of the fruit of the nutmeg tree, *Myristica fragrans* (see Plate, SPICE PLANTS, No. 2), growing largely in the Malay Archipelago. As these spices are generally bought in their original condition adulteration is not easy or of frequent occurrence. The fruit of the nutmeg tree resembles a peach in size, and when ripe the fleshy portion splits into two, revealing the seed closely enveloped in a deep-red branching arillus. This aril is the *mace*, which, on removal and drying in the sun, becomes of a buff colour. The seed is also dried, and, after removal of the hard shining coat, it forms the *nutmeg* of commerce. Nutmegs are of a greyish-brown colour outside, due to the practice of liming to which they are submitted. The interior is grey in colour and oily. Nutmegs contain very large amounts of fixed oil, together with some volatile oil, the total fatty content amounting to about 36 per cent of the seed.

Nutmeg and Mace.

Mace is brittle and translucent, occurring in commerce in pieces about $1\frac{1}{2}$ in. long. It contains about 22 to 37 per cent of oil. The commonest form of adulteration of mace is the substitution of *false* or *Bombay mace*. This variety is almost devoid of aroma and flavour, and its sale constitutes a distinct fraud. A test for distinguishing this adulterant from genuine mace consists in steeping strips of filter paper in an alcoholic solution of the suspected mace. On treating the paper with dilute sodium hydrate solution a red colour is produced if Bombay or wild mace is present.

Adulteration of Mace.

AROMATIC SEEDS

Seeds are not used to any large extent in the whole, unground state, in bread or confectionery. The principal seed used in England is the caraway, but in Continental bakeries a wider variety of seeds are in use, chiefly for sprinkling over finished goods, as semmels, pretzels, &c. Among seeds in frequent use may be noted aniseed, coriander, caraway, fennel, poppy seed.

Aniseed, the fruit of anise (*Pimpinella Anisum*), is a native of Egypt, but now cultivated in many parts of Europe. The fruit is ovoid in shape, tapering to a point at the top. It is of a greyish-brown colour, about $\frac{1}{8}$ in. long, and usually has the stem attached at the base. Anise contains from 2 to 3 per cent of essential oil. The oil, either in the

Aniseed.

SPICE PLANTS

1. Clove.
2. Nutmeg.
3. Cinnamon.
4. Black Pepper.
5. Allspice or Pimento.

SPICE PLANTS

form of alcoholic tincture or essential oil, is largely used in the preparation of cordials and in confectionery.

Coriander is the fruit of *Coriandrum sativum*, a native of Italy and the Mediterranean coast. In shape it is globular, about ¼ in. in diameter, and having ten fine ribs upon its exterior. The remains of the calyx teeth are usually to be found at the top. The colour is light brownish-yellow, sometimes in places passing to purple. The fruit is hollow, and crushes readily in the fingers. Coriander is used for flavouring gingerbread, honey cake, jellies, &c., whilst the alcoholic extract is used for improving the flavour of low-grade cocoas in chocolate manufacture. The flavour of coriander is mild and faintly sage-like. **Coriander Seed.**

Caraways are by far the most widely used of all seeds in the whole state. In England they are still used to a very large extent in cake and biscuit manufacture, but the alcoholic extract is slowly displacing the seed in many districts. The caraway is the fruit of *Carum Carvi*, a native of Europe. The small seed-like fruits are somewhat spindle-shaped, about ¼ in. long, and curved slightly. In colour they are nearly black, with sharp ribs of light brown running the length of the seed. The flavour is pungent and stimulating. The chief method of sophistication consists in exhausting the whole seeds by alcohol. **Caraway Seed.**

Fennel is the fruit of a wild plant (*Fœniculum vulgare*). At one time this was known in America as " meetin' seed ", from the custom among the Puritans of taking sprigs of it to church to nibble during the service. Fennel closely resembles caraway in shape, but it is considerably longer and broader. In colour it is sage-green, with ribs of brown. In flavour fennel is quite unlike caraway, being closely similar to anise, though somewhat more pungent and penetrating. The seed, both whole and ground, is used in cookery. The essential oil also is used for flavouring confectionery. **Fennel.**

CHAPTER L

ESSENCES AND ESSENTIAL OILS

The flavouring substances most frequently used by bakers and confectioners are liquids, since fluids lend themselves most readily to thorough incorporation and accurate dosage. The absence of inert matters which tend to darken colour or mar the appearance of the goods places them far in front of spices.

There are two principal kinds of these liquids, viz., essences and essential oils. *Essences*, including liqueurs, waters, &c., are fluids in which alcohol is the chief constituent, forming the solvent for the flavouring matter. *Essential oils* are the actual flavouring principles in the most concentrated form. For most purposes the essential oils are to be preferred **Essences and Oils.**

to the essences, waters, and other extracts, but it is not always possible to obtain them. For instance, the essential oils of strawberry, raspberry, and many other fruits are not known, and they are therefore represented by artificially prepared essences.

Essential Oils.

Essential oils are obtained from practically every part of the plant anatomy. Fruit, flower, seed, leaf, bark, wood, root, each and all are laid under contribution. As a rule, however, the characteristic oil is located in greatest amount in one part only; for instance, lemon and orange oils in the rind of the fruit. In some cases the oil can be obtained from every part of the plant, as in the case of peppermint. Essential oils are nearly all limpid liquids. They are, when pure, probably all colourless; but as obtained in commerce they usually exhibit more or less colour due to small quantities of impurity extracted from the plant with the oil. Almost all are insoluble in water, and for this reason the addition of water to alcoholic extracts causes turbidity to occur. They are all very inflammable, and burn fiercely with much smoke. Most of these oils distil under atmospheric pressure, and all pass readily in a current of steam; they possess a hot burning taste and very pronounced odours, some pleasant, some otherwise. Essential oils do not feel greasy to the touch, but impart a rough, dry feeling to the skin; they have, indeed, no connection with the fatty oils whatever, and the name oil is a misnomer. It is, however, retained partly by custom, and used to indicate that the substances are the concentrated principles embodying the odour and flavour of the materials from which they are obtained. The essential oils undergo oxidation very readily, and they should consequently be stored in small bottles, kept as nearly full as possible, in a dark place. In specific gravity these oils vary greatly, some being lighter than water, and others heavier. Though insoluble in water, they are more or less soluble in almost all organic liquids—alcohol, ether, chloroform being the chief solvents. In chemical composition they vary enormously, many of them being complex mixtures of chemical compounds. Most of them can be classified into two groups, as (I) *Volatile Oils* or *Hydrocarbons*, and (II) *Oxygenated Oils* or *Aldehydes and Ketones*. The principal methods of winning these oils are by expression, distillation, and extraction by solvents. Descriptions of these methods will be given in dealing with the individual oils.

Adulteration of Essential Oils.

It is necessary to utter a word of warning in connection with the purchase of essential oils. Probably in no other trade has adulteration become such an art involving so little risk of detection as is the case to-day in the essential-oil industry. Except by the highly trained chemist, who has specialized in this branch of analysis, the detection of adulteration is a matter of practical impossibility, and it is quite possible for every official test to be met by an oil which is entirely an artificial mixture. It is therefore absolutely necessary to purchase only from those reputable firms who will sell under strict guarantee that the articles are genuine natural products. It is perfectly true that in many

cases the synthetic products are identical in chemical composition with the natural ones; still, it is better to purchase such substances at market rates, with one's eyes open, as artificial products, than to buy them at an enhanced figure under the impression that they are cheap natural ones. Again, it must be remembered that the strongest smelling and tasting oils are not always the most satisfactory. Flavour should always be more or less a creation of the mind, just induced by a suspicion of some marked principle rather than that coarse biting taste which overpowers the taste nerves and revolts the educated palate. Great moderation should always be exercised in the use of these concentrated materials, so as to avoid spoiling good products through a too liberal use of the flavour bottle.

Of all the essential oils, that of lemon is the sheet-anchor of the confectioner, and used in just the right proportion none is more pleasant and refreshing. Unfortunately this essence is sometimes used in such lavish quantity to mask inferior ingredients of the mixing that there is danger of its falling into bad repute. *Oil of lemon* is obtained from the fruit of *Citrus limonum*. It is generally prepared during the months of November to April. The chief centre of the industry is Messina, though much is also produced in the Palermo district of Sicily. The oil is obtained sometimes by means of strong pressure upon the rinds, by which the oil cells become ruptured and the oil escapes and is collected on the surface of water. Another method consists in removing the rinds in three pieces, scraping the surfaces, and pressing upon a sponge. The sponge is afterwards squeezed to recover the oil. By this process a worker can produce 1½ lb. of lemon oil per day. Recovery by distillation is not practised except in the case of poor qualities, since lemon oil is injured by this process. To purify the oil it is simply filtered.

Oil of Lemon.

Citral is the constituent to which the flavour and odour of lemon oil are chiefly due, and it occurs in pure oil to the extent of about 5 to 7 per cent. The great bulk of the remainder of even pure lemon oils consists of terpenes. Unfortunately even the citral content cannot be relied upon as a test of purity, for low-grade lemon oils are commonly fortified by the addition of citral obtained from lemon-grass oil. Citral is artificially prepared by oxidizing geraniol with chromic acid. Other methods of adulteration consist in treating orange oil with turpentine in such quantity as will escape detection. The chief method of adulterating now consists in adding the "terpenes"—obtained in the process of making "terpeneless" oils—to turpentine. It is practically useless to test lemon oils for adulteration by any simple process, since every test of the Pharmacopœia is easily evaded by the adulterator.

Flavouring Agent in Lemon.

Lemon oil is imported in original coppers containing 10 to 100 lb., and genuine oil will cost about 5 to 6 shillings per lb.

Lemon essences should contain 5 per cent of lemon oil in dilute alcohol. In making cheap essences the chief object is to use as little alcohol as

possible on the score of expense; but if less than 45 per cent spirit is used no lemon oil will be dissolved at all. Still, such fluids are frequently made, and they do possess a certain odour and taste of lemon, although no oil can be detected by analysis. The flavour is sometimes reinforced by artificial citral, citronella, or lemon-grass oil, whilst colouring in the form of turmeric or coal-tar dyes is used to obtain the characteristic tint.

Essence of Lemon.

Oil of orange is obtained from orange peel in the same manner as lemon oil is prepared. It is a yellow-coloured liquid, of mild flavour, sometimes used as a substitute for lemon oil after mixing with terpenes or turpentine to impart the necessary pungency.

Oil of Orange.

Lemon-grass oil is obtained by distillation from *Andropogon citratus*, a grass cultivated in India. The oil is reddish-yellow in colour, with an intense lemon-like odour and flavour. It contains large quantities of citral, amounting often to 75 per cent.

Lemon-Grass Oil.

Citronella oil is the distillation product of the grass *Andropogon Nardus*. It is a yellowish to brown liquid. It does not resemble lemon oil very much in odour, though its flavour is somewhat similar.

Citronella Oil.

Peppermint oil is the product of *Mentha piperita*, growing wild in some parts of England, and cultivated to some extent in Cambridgeshire, but notably at Mitcham, Surrey. The whole plant is rich in the fine-flavoured oil, which is obtained by distillation. The oil has a greenish-yellow colour usually, and the odour is strong and penetrating. It contains menthol, to which the cold feeling in the mouth is attributable. The oil should dissolve in four times its volume of 70-per-cent alcohol.

Oil of Peppermint.

Peppermint essence should contain 3 per cent of the essential oil.

Essence of Peppermint.

Among the many other essential oils may be mentioned the various extracts of orange flowers, e.g. *neroli, petit grain, otto of roses.* These oils are prepared principally for the perfumery industry, but they also form the basis for some of the waters used in flavouring lozenges, &c., in confectionery.

Flower Essences.

Essential oils can be prepared from all spices and aromatic seeds, and consequently essential oils of anise, cloves, coriander, cassia, cinnamon, caraway, ginger, mace, and nutmeg are commercial products. They are obtained by the general methods already mentioned, the process being adapted to produce the finest quality of oil. In many cases these essential oils are displacing the spice mixtures, of which they form the flavouring principle, the reason for this being largely, that the use of the oils obviates the disadvantage of introducing quantities of inert coloured cellular and fibrous matter into mixings, thus to some extent affecting the delicacy of colour. By using essential oils also various delicate blended flavours can be obtained, which would be almost impossible if the spice substances had to be used.

Essential Oils from Spices.

Oil of bitter almonds is obtained by maceration of crushed bitter almonds in water and subsequent distillation of the liquid, the distillate being the impure oil. The bitter almond, *Amygdalus communis*, was the original source of this flavouring material, and hence the name which is now applied to this oil whatever source it is prepared from. It may be obtained from peach, plum, and apricot kernels, laurel leaves, mountain-ash bark, and indeed all members of the group Amygdalinæ. The oil does not exist free in these bodies, but is contained in the form of a glucoside known as *amygdalin*. This substance can be split into three parts, forming respectively benzaldehyde, glucose, and hydrocyanic acid. The formula for this change is usually written thus:— **Oil of Bitter Almonds.**

$$\underset{\text{Amygdalin.}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{2H_2O} = \underset{\text{Benzaldehyde.}}{C_7H_6O} + \underset{\text{Hydrocyanic acid.}}{HCN} + \underset{\text{Glucose.}}{2C_6H_{12}O_6}$$

This change is brought about by the agency of a ferment or enzyme found in almonds, called *emulsin*. When the crushed nuts are macerated in water the above change takes place, and upon distillation of the liquid the benzaldehyde and hydrocyanic acid pass over with some of the water. Hydrocyanic acid (prussic acid) is a deadly poison, and the distillate is freed from this dangerous impurity by means of lime water and ferric chloride. The oil is then redistilled and dried over calcium chloride. It is well when buying natural oil of bitter almonds to obtain a guarantee of freedom from prussic acid. **Prussic Acid in Almonds.**

Benzaldehyde is a faintly yellow mobile liquid having a burning bitter taste and strong almond odour. It boils at 180° C. (356° F.), and on standing in air becomes oxidized to benzoic acid. It is very soluble in ether and alcohol and but slightly so in water. Benzaldehyde can be synthetically prepared by many methods, perhaps the best being treatment of toluene by chlorine. The benzyl chloride thus formed yields benzaldehyde on distillation with lead nitrate. Thus the oil is obtained directly from coal tar. This synthetic oil has exactly the same chemical constitution as the natural oil, and has in consequence largely replaced it upon the market. Its chief claims to use are entire freedom from any trace of prussic acid, and great cheapness. **Artificial Oil of Almonds.**

Benzaldehyde was at one time often substituted by *oil of mirbane*, but the discovery of synthetic methods of making the true oil has almost entirely superseded the use of this artificial substance. *Nitrobenzene* is the true chemical name for this body. It is a heavy yellow oil, boiling at 205° C. (401° F.), and having a strong sickly odour and taste of almonds. It is obtained by nitrating benzene and distilling the product to purify it. Its chemical formula is $C_6H_5NO_2$, and it will be seen that it is quite unlike true benzaldehyde in composition. Nitrobenzene is markedly poisonous, and instances of death through inadvertence have occurred on several occasions. This substance should on no account be used as **Dangerous Substitute for Oil of Almonds.** **Nitrobenzene.**

a flavouring agent in food-stuffs, and no justification whatever can be urged for its employment. To detect nitrobenzene boil 15 c.c. of the extract with a little strong potassic hydrate solution. A blood-red colour will result with nitrobenzene. Nitrobenzene is only about one-third the price of synthetic benzaldehyde or the common natural oils obtained from peach kernels.

Ratafia and Kirsch. *Ratafia* and *kirsch essences* owe their principal flavours to benzaldehyde.

The *vanilla* bean (vanilloes) is the fruit of a climbing orchid, *Vanilla planifolia*, indigenous in South America and the West Indies. Mexican beans are the most highly prized; but practically the whole available supply is absorbed in America, the European demands being met chiefly by the Seychelles and Mauritius products. The beans, as they are erroneously called, are about 8 in. in length and $\frac{3}{8}$ in. thick, narrowing and slightly curving toward the ends. They have a rich dark-brown colour, and feel waxy to the touch. Deep rifts traverse the length of the pods, the surface of which is frequently covered with a fine frost-like coating of vanillin crystals. In the centre of the pods a thick yellow granular balsam is found, and to this the delicious odour of the fruit is largely due. This balsam is not soluble in water, and when very dilute alcohol is employed it is not extracted, and consequently extracts weak in alcohol are inferior in quality. Upon soaking in water the pods swell up and become triangular in shape. When gathered, the fruits are of a yellowish-green colour and without odour. The odour is developed as the result of a fermentation or "sweating" process, the method differing slightly in various countries. The best method consists in sun-drying the pods for about a month, with alternate pressing between blankets and exposure to the air. The famous Mexican vanilla is prepared in this manner. Another method consists in using artificial heat, and then drying the pods by exposure to calcium chloride. By this means the time of maturation is greatly reduced, but the quality of the pods cured in this manner is decidedly inferior. Vanilla owes its characteristic odour and flavour to the chemical compound *vanillin*, a derivative of protocatechuic aldehyde. This substance crystallizes in fine needles. It is scarcely soluble in water, but readily in alcohol, ether, and chloroform. Its melting-point is 80° C. (176° F.).

Vanilla Beans.

The quantity present in vanilla pods is variable, and the highest prized beans have the smallest content of vanillin, as the following figures of Tiemann and Haarman show:—

Vanillin in Vanilla Beans.

Mexican beans	...	...	...	...	1·69 per cent vanillin.	
Bourbon	„	...	...	...	...	2·48	„
Java	„	...	...	...	...	2·75	„

In addition to vanillin, the pods contain notable amounts of gum, resin, sugar, &c., all of which contribute to the formation of the final flavour.

Vanillin ($C_8H_8O_3$) can be produced artificially in a variety of ways.

Originally it was obtained by the oxidation of coniferin, a substance occurring in pine trees. This process, however, is now superseded by one which consists in using eugenol and iso-eugenol as the base substances, which upon oxidation in alkaline solution yield vanillin. Eugenol is found in large amount in clove oil. Many other methods are also now in use. The vanillin obtained artificially is identical with natural vanillin in all respects, being a pure chemical substance; but it does not possess the full bouquet associated with natural extracts from vanilla pods.

Artificial Production of Vanillin.

Genuine vanilla extracts should contain 10 parts of the soluble matter from vanilla pods in 100 parts of dilute alcohol. Most extracts are sweetened with sugar, and many contain also glycerin. The best extracts are obtained by macerating the pods in alcohol for several months. The content of vanillin in even the best extracts rarely exceeds ·2 per cent. Some makers use alkalies to obtain greater extractions, especially when using very dilute alcohol, but this practice greatly injures the flavour. Adulterations of vanilla extract usually take the form of substituting artificial vanillin and colouring the product with caramel. Body and colour also is imparted to factitious extracts by means of prune juice. Tinctures of coumarin and tonka beans are also largely used as substitutes for vanilloes. Such artificial compounds, whilst often possessing a strong vanilla flavour, are nevertheless much coarser, and lack the refinement so marked in genuine extracts. Another form of adulteration consists in treating the marc, after alcoholic extraction, with water, and fortifying the liquid obtained with artificial vanillin and colouring matter.

Vanilla Extract.

Tonka beans are seeds of a tree native in Guiana, and known as *Dipteryx odorata*. The pods are almond-shaped, having a single seed about 1½ in. long, in shape like a kidney bean. The bean is of a dark-brown colour, with a shining, brittle skin. The active principle is *coumarin*, the anhydride of coumaric acid. Coumarin can be extracted from the beans by means of alcohol; it crystallizes in slender needles, shorter and thicker than vanillin crystals. The melting-point is 67° C. (153° F.). Coumarin is only slightly soluble in water, but very soluble in alcohol, ether, &c. Coumarin is now synthetically prepared by heating salicylic aldehyde with acetic anhydride and sodium acetate. The resulting acetocoumaric acid decomposes, forming acetic acid and coumarin. This artificial coumarin is often used in making factitious vanilla extracts. The presence of coumarin in vanilla extracts is readily detected by anyone acquainted with both kinds, by the odour alone. In the case of coumarin the odour is always more pungent than vanillin, and when in admixture it usually predominates over the milder vanilla odour. Acetate of lead added to a portion of the extract should produce a heavy precipitate with genuine vanilla extracts. If none is obtained this is conclusive proof that the extract is artificial. If only a cloudy precipitate is obtained which does not settle

Tonka Beans.

Artificial Coumarin.

well, the extract should be regarded with suspicion, as it is probably coloured by caramel.

Use of Vanilla.

Vanilla is used in a variety of ways. Either the pod is pulverized and used, as in the case of chocolate-making, or it may be used as a tincture, or mixed with sugar either as the whole pod or as extract. Vanilla extract is made by macerating 3 to 4 oz. of the finely chopped pods in 1 pint of rectified spirit, 50 per cent strength, for about one month. Filter and preserve in a closely stoppered bottle. Vanilla sugar is made by dissolving 1 oz. of vanillin crystals in 4 oz. of alcohol by warming to 35° C. (95° F.). Pour over about 14 lb. of sugar in a mortar and mix thoroughly. Leave exposed to air for twenty-four hours to dry, and then pack into a stoppered bottle to store.

Vanillons.

Vanillons are the fruits of the wild vanilla plant. The odour is quite unlike that of true vanilla, and resembles heliotrope rather closely. These beans are used only in perfumery.

CHAPTER LI

LIQUEURS AND FRUIT ESSENCES

Liqueurs

Liqueur Flavourings.

Liqueurs are simply strong alcoholic syrups, in which small quantities of certain essential oils are dissolved. For the purpose of making them it is necessary that the oils used should not cause turbidity upon addition of water, or else the appearance of the product would be spoiled. For this reason only oils containing little or no resin can be employed, and oxygenated oils are mostly drawn upon. In the preparation of confectionery, ices, &c., the most highly prized liqueurs are the following:—

Curaçoa.

Curaçoa is made by distilling spirits in which have been soaked cinnamon, curaçoa peel (a rare species of orange), and other spices. De Brevans gives the following recipe for its preparation:—Alcohol (85 per cent), 5 litres; cinnamon, 4 gm.; mace, 2 gm.; rasped skins of 18 oranges; white sugar, 1750 gm. Macerate the alcohol and spices for fourteen days. Distil and add sugar to distillate, and colour with caramel.

Maraschino.

Maraschino was originally obtained from the sour Italian cherry. It is now commonly made by distilling a mixture of wild cherries, raspberries, cherry leaves, peach nuts, and orris root, sugar being added to the distillate.

Benedictine.

Benedictine contains much sugar, and is flavoured by angelica, hyssop, nutmeg, and peppermint.

Chartreuse.

Chartreuse is similarly made.

Angostura is made with Angostura bark and other spices. **Angostura.**

Crême de Menthe, according to De Brevans, is made as follows:—Peppermint, 600 gm.; balm, 40 gm.; sage, 10 gm.; cinnamon, 20 gm.; orris, 10 gm.; ginger, 15 gm.; alcohol, 80 per cent, 5030 gm.; sugar, 3750 gm. **Crême de Menthe.**

The green colour is sometimes imparted by chlorophyll in the best qualities, but in cheap grades it is obtained by coal-tar dyes.

Fruit Essences

Fruit essences are almost entirely artificial productions, since it is practically impossible to extract from the fruits their distinctive flavours in quantities sufficient for commercial purposes. **Nature of Fruit Essences.**

As a rule, these flavours are compounded from various ethers; and whilst these do possess a certain resemblance to the real fruit flavour, yet they are generally much coarser and lack the delicacy which is so distinctive of the natural substances. Some of the compound ethers bear odours and flavours which strikingly resemble certain fruits, and such can be used singly. In other cases complex blends have to be made in order to simulate nature. It is needless to remark that such substances should never be sold as "pure fruit essences", but should always be declared as of artificial origin. Among the best-known essences are the following:—

Pineapple essence is butyric ether dissolved in alcohol. It is prepared by mixing butyric acid and alcohol in equal parts, and treating with concentrated sulphuric acid. The mixture is distilled to obtain the ether. It is a colourless liquid insoluble in water, with a boiling point of 228° C. (442° F.). **Pineapple Essence.**

Pear essence is an alcoholic solution of amyl acetate. The ether is prepared from amyl alcohol and potassium acetate by distillation with sulphuric acid. The colourless distillate is insoluble in water and boils at 137° C. (279° F.). **Pear Essence.**

Apple essence is amyl valerianate dissolved in alcohol. It is made by taking equal parts of amyl alcohol and sulphuric acid and adding to the cooled mixture valerianic acid, and subsequently distilling. The ether boils at 188° C. (370° F.). **Apple Essence.**

An extraordinary number of blended essences are put upon the market. Among the more important may be noted the following, the formulæ for which have been selected from Kletzensky's table in the United States Dispensatory. In all cases the number of parts given in the table are to be added to 100 parts of rectified alcohol. **Composition of Fruit Essences.**

In many cases instead of using essences or oils it is more satisfactory to use the fruits themselves for flavour. Thus, lemon flavour can be imparted to cakes and ices best by using the zest; orange by using peel cut so fine as to be imperceptible in the cakes. Ginger in the **Real Fruit Flavours.**

preserved form is an excellent addition to rich cakes. When oils or essences are used it is better to obtain good qualities and use them with great care.

TABLE FOR COMPOUNDING FRUIT ESSENCES

	Strawberry.	Raspberry.	Gooseberry	Grape.	Cherry.	Plum.	Currant.	Apricot.
Chloroform	—	—	—	2	—	—	—	1
Nitrous ether	1	1	—	—	—	—	—	—
Aldehyde	—	1	1	2	—	5	1	—
Acetic ether	5	5	5	—	10	5	5	—
Formic ether	1	1	—	2	—	1	—	—
Butyric ether	5	1	—	—	—	2	—	10
Valerianic ether	—	—	—	—	—	—	—	5
Benzoic ether	—	1	1	—	5	—	1	—
Œnanthic ether	—	1	1	10	—	—	1	1
Oil of persicot	—	—	—	—	2	4	—	—
Sebacic ether	—	1	—	—	—	—	—	—
Methyl salicylic ether	1	1	—	1	—	—	—	—
Amyl alcohol	—	—	—	—	—	—	—	2
Amyl acetic ether	3	1	—	—	—	—	—	—
Amyl butyric ether	2	1	—	—	—	—	—	1
Saturated alcoholic solution of—								
Tartaric acid	—	5	5	5	—	—	5	1
Oxalic acid	—	—	—	—	—	—	—	—
Succinic acid	—	1	1	3	—	—	1	—
Benzoic acid	—	—	1	—	1	—	1	—
Glycerin	2	4	—	10	3	8	—	4

In addition to the flavours already given may be added *butter flavour*, now frequently sold for use in goods made with the various substitute fats, to impart butter flavour. This essence consists of butyric ether dissolved in alcohol, sometimes with the addition of traces of myristic ether.

Butter Flavour.

CHAPTER LII

FERMENTED BUNS

Not so many years ago the craft of the confectioner in Great Britain was as much separated from that of the bread baker as it is still in most Continental countries. The cooks—men and women—were the confectioners, and while there was a firmly-established craft of old English confectioners, their duties were not distinctively confined to flour confectionery. The old title of pastry cook betrays the position they occupied as attendants on cooks, or as cooks themselves, with pastry baking as a sort of by-occupation. Midway between the cooks and the bread bakers were the biscuit bakers, who were of very great importance in the days before the biscuit factories. Modern developments have resulted in the pastry cook becoming more and

The old Cook Confectioners.

Old-time Biscuit Bakers.

more divorced from his duties as cook, and more and more engaged in those of the pastry baker. This is especially true of those who are employed in ordinary bakery establishments, but is not quite so true of those employed in the kitchens of hotels and restaurants. The old confectioner was also a man who had to concern himself a great deal with sugar and sugar-boiling. His modern representative has still to know a great deal about sugar, but is much less of an expert in sugar-boiling. The reason of this seems to be that the tastes of the consuming public in the matter of table confectionery have very much altered, and there is a dwindling demand, or an entire disappearance of the demand, for the elaborate and costly confections made from pulled and spun sugar, the place of which has been taken by Continental delicacies in which fondant and flavoured creams occupy so prominent a place.

Place of the Pastry Cook.

Public Taste Altered.

The occupation of the biscuit baker as a distinctive craftsman has also suffered by the change of public taste and by the competition of the large factories. The modern confectioner has therefore to gain an exhaustive experience of the kind of goods which not so long ago were considered purely Continental. He has also to take up the residuum of the work which used to be done by the biscuit baker, and last but not least, he has to be skilful in producing the common goods which form the bulk of the sales in the majority of bakers' shops.

Biscuit Bakers Crushed Out.

Modern Flour Confectioner.

There are still a great many establishments in which flour confectionery only is made, a larger number still in which bread and confectionery are kept strictly apart, some in which both are produced by the same hands, and some in which bread only is made. But these distinctions and divisions are gradually disappearing. There are very few bread bakeries in which cake and some sorts of confectionery are not now being made, and, on the other hand, those which have hitherto been devoted only to the confectionery trade are gradually opening out with bread.

Mixture of Trades.

To meet the needs of all, the purpose underlying the scheme of the Confectionery Section of this work is to deal with the whole confectionery trade thoroughly, nothing being considered too plain, cheap, or common to warrant neglect, and nothing too costly or uncommon to place it out of the range of careful treatment. In pursuance of this plan the simplest matters relating to confectionery—the consideration of the goods, in fact, which usually fall to the bread bakers to make—will be dealt with first. Buns answer this description, and are otherwise worthy of first place, because they are old in favour and yet seem to retain the respect if not the love of the average customer amidst all the changes of taste that are taking place in other directions.

The Bun.

In making fermented buns there are certain considerations which are common to all sorts and varieties. Amongst these it is important to take stock of the kind of flour with which the best results are to be obtained. The nature of the flour, perhaps, more than anything else determines the kind of bun that will be produced.

Influence of Flour in Buns.

If only bulk is to be considered, then very strong flour may be used, the fat employed being to some extent corrective of the harshness which follows the use of very strong flour by itself in bread. But as softness and keeping properties are of really more consideration than bulk, flour that is a little less than the strongest is very suitable for all this class of goods. The writer has obtained these qualities in buns to a high degree when using a patent grade Kansas flour, a high grade Australian, and a patent grade British-milled flour. In recipes sometimes made public, the use of Hungarian or, as it is generally called, Vienna flour, is strongly advised, but, except for buns that are not wanted large, and that can be sold at a full price, it is a mistake to use this sort of flour, when better results can be obtained by the use of the products of our own mills at a lower price. Flour that is suitable for bread-making, containing almost 10·5 per cent of dry gluten, is generally suitable for fermented buns. A reservation may, however, be made in the case of very rich buns of the Bath type. These, owing to their richness, are not wanted large, and not being fermented very much, would be tough if made with very strong flour. Flour of the Hungarian or Australian sorts is therefore best suited for such goods.

Strong Flour Mellowed.

Kansas and Australian Flour for Buns.

Hungarian Flour for Rich Buns.

It is an almost invariable practice in bun-making to make a ferment with milk, sugar, flour, and yeast as a preliminary stage. The object is to make a small quantity of yeast do a great quantity of work by actually multiplying the number of yeast cells in the ferment itself; but probably quite as much advantage is obtained by the development of the yeast cell in its flour environment, which is akin to a sort of acclimatizing influence that fits it better to stand the conditions prevailing in the subsequent dough stage. It is not impossible to make buns, and very satisfactory buns, too, by the straight-dough method, but the yeast in such cases seems to work much slower, especially at the beginning of the process. The explanation seems to be that the presence of so much fat and sugar mixed with the flour produces a condition not very favourable to the activity of yeast when it is first immersed in it.

Purpose of Ferment Stage.

Use of Ferment in Bun-making.

Straight-Dough Buns.

There is great diversity of opinion amongst bakers and confectioners as to the proper quantity of flour and other ingredients to use in the ferment. Some favour one that is very thin, whilst others think the best results are obtained with one that is rather thick, or, as it is called, a strong ferment. It may be urged against a very thin mixture that the flour in such a ferment falls to a layer at the bottom, and although the sugar added, with that naturally in the flour, as well as the soluble proteids of the latter, will still be available for yeast food and growth, the ferment is unsatisfactory, because it either does not rise in a healthy way or it drops too soon. A very thick ferment, on the other hand, is more like a soft dough, and confines the action of the individual yeast cell to a very prescribed area, because there is little or no

Thin versus Thick Ferments.

flow of the material of the ferment from one part to another. The best results are obtained with a ferment that is just thick enough to support its own material without allowing the flour to deposit, and yet not thick enough to prevent a free movement of the material, and therefore of the yeast within the ferment. This result will generally be obtained by using about 8 oz. of flour to 1 qt. of liquor, whether milk or water. It is quite a safe plan to make and maintain a ferment at 86° to 90° F., and this will generally require water about 100° to 104° F. A ferment of this kind should drop in from thirty to forty minutes. Some men are very particular to reckon the amount of sugar in the ferment as a deduction from the total sugar required to sweeten the buns, but this need not be done. It is not necessary to have more than 2 or 3 oz. of sugar for each quart of liquor used in the ferment, but it should be remembered that after this sugar has been fermented it has no sweetening effect whatever. As yeast growth and not gas production is the desideratum in a ferment, it is a mistake to use even the larger quantity of sugar here stated at the ferment stage, as it is known that when yeast is at its maximum activity in producing gas and alcohol it is less active in producing new yeast. The latter effect may be increased, however, by the manner in which the ferment is prepared. The yeast should be thoroughly broken down and mixed in a small portion of the water only, as it evades the mixing utensil if first placed in the whole of the liquor. When made into a paste with some of the water it may then be easily mixed through the remainder. The sugar should be added, then the flour, and a small hand whisk used to mix thoroughly and aerate the whole ferment. The incorporation of a considerable quantity of air in this way is credited with increasing the vitality and activity of the yeast, if only care is taken not to reduce the temperature.

Proper Quantity of Flour in Ferment.

Temperature for Ferments.

Sugar in Ferment.

Sugar not a Yeast-producer.

Aerating Bun Ferment.

Some profess to find great virtue in adding part of or all the eggs at the ferment stage, but the advantages are very doubtful. If only a few eggs are to be used in a mixing, their addition to the ferment is a matter of little moment, but if the ferment is one for rich buns, the addition of the eggs at that stage acts rather as a cloy or hindrance to yeast activity. The proteids of egg or of the parts of egg are not directly suitable for yeast food, and their addition to the ferment is not, therefore, as some suppose, a means to greater vitality.

Eggs in Ferment.

Coming now to the dough stage of bun-making, it is important to note that, with regard to both fat and sugar, there are limits to the proportions that may be used. For fats, experience teaches that it is nearly impossible to get any fermentation at all if more than 4 oz. of fat to each 1 lb. of flour is used. With care in handling this quantity can be used, but only along with moderately strong flours, and then only if the fat is added in such a way as not to give the flour a greasy feel. On this account it is better, if the quantity of fat is large,

Effects of Excessive Fat.

to rub it in with the flour very loosely, rather than to run it in melted, or rubbed amongst the flour very finely. One very curious point about the influence of fat on flour is, that if these be rubbed together and then allowed to lie for a week or two in that condition, and then made into bun dough with a ferment, the dough will flatten out and look greasy and the yeast activity will be almost stopped. This effect is produced even if the quantity of fat used is not excessive. The only reasonable explanation that can be offered is that in some way the starch of the flour, with the sugary and proteid matter adhering, gets coated over with grease, which thus imprisons, as it were, the materials on which the yeast works and lives. Nearly the same effects are produced if yeast is immersed in oil or melted fat before being used in a ferment or bun dough. In this case the yeast cells are evidently rendered impermeable to food from outside, whilst their enzymes are from the same cause prevented from coming out to perform their usual functions.

Mixing Fat or Melting.

Cause of Fat affecting Fermentation.

Effects of Oil or Fat on Yeast.

Nearly the same limit—viz. 4 oz. per lb. of flour used—is the maximum in the case of sugar. If a larger proportion than this is mixed the buns will not ferment, but run out flat. This may be the result of two distinct causes. The amount of sugar here stated—4 oz. per lb. of flour—would be equivalent to about a 40-per-cent solution if the quantity of liquid used is taken as the basis of measurement, and it is well known that a sugar solution of this density offers a very unsuitable medium for the growth of yeast. The other part explanation of the flattening of the buns may be that already referred to in connection with the effect of too much sugar in bread, that the gluten of the flour is softened, and its elasticity destroyed by an excessive quantity of sugar.

Effects of Excessive Sugar.

As a basis for all bun calculations, it is safe to assume that for every 1 lb. of flour used not more than $3\frac{1}{2}$ oz. of fat and $3\frac{1}{2}$ oz. of sugar can be used; and as a matter of fact these quantities, without any addition of eggs whatever, produce buns that keep soft and moist for a considerable time, and are otherwise satisfactory.

General Basis for Buns.

Eggs are certainly useful in giving buns a rich colour and a fine appearance when new, but they do not keep the buns moist in the same way as the maximum quantity of yeast and sugar mentioned above does.

Eggs not Necessary.

One defect in flavour of ordinary buns made with sugar, lard, eggs, yeast, and flour is a certain insipidity or mawkishness that is hardly pleasant. This is not very noticeable in those containing much fruit, but it is in plain sorts; and to improve the flavour it is rather a common practice to add essence of lemon. This is not harmful if used in moderation, but the rule is generally to use too much. If butter is used in buns, or even if the fat is lard or other tasteless sort, the addition of $\frac{1}{2}$ oz. of salt at the dough stage, to each 4 lb. of flour used, removes the insipidity referred to, without in any way destroying the sweetness or seriously hindering the fermentation.

Flavour of Buns.

Salt in Buns.

For a common plain bun that pays to sell at about seven for 3*d.* the following mixture may be used. Make a ferment with 1 qt. milk and 1 qt. water, the two together at 100° F. Stir into this 4 oz. sugar and dissolve 5 oz. yeast, then beat 1 lb. of flour well into it with a whisk. This ferment, kept in a warm place, will rise and drop in about thirty-five minutes. Make dough with 8 lb. flour, into which 1¾ lb. of lard or neutral fat has been rubbed, 1½ lb. sugar, and 1 oz. salt, and the ferment as above. Let the dough stand exactly one hour; then knead well and scale into pieces 3½ lb. each to cut on the machine into thirty buns. These are rolled and placed on greased baking sheets, and proved in a steam cupboard for about twenty-five minutes. The buns may be glazed with egg wash, consisting of one egg and enough water to fill half the shell, just before setting in the oven, in which case either a camel-hair or a paper brush must be used. They may be glazed while hot after baking with one of the following glazes: (1) The plain egg wash described above; (2) a glaze made with 1 egg, a gill of water, and 1 oz. sugar; (3) clear syrup made by boiling about 6 oz. sugar in ½ pt. water, in which ½ oz. gelatine has been previously soaked; (4) a clear strong syrup alone. Any of these will produce a good glaze, the last one being the least satisfactory, as, unless it is washed on immediately the buns come from the oven, they are liable to be sticky. This mixture may be used for plain buns, or for small afternoon tea buns or fingers (see Plate, FERMENTED BUNS, Nos. 2, 3, 9, 11), or for Sally Lunns, which are simply bun dough pinned out flat for 1*d.* size, or baked in hoops for 2*d.* size.

Plain Buns.

Bun Washes.

Sugar Wash.

The following recipes are all well tried, and will produce buns of excellent quality, at the same time giving variety, which is so conducive to good business. The old familiar currant buns may be made as follows:—

CURRANT BUNS

Ferment set with liquor at 100° F.	*Dough*
1 pint milk.	4 lb. flour (English patent).
1 pint water.	6 oz. butter.
3 oz. sugar.	¼ lb. lard.
8 oz. flour.	½ lb. sugar.
2¼ oz. yeast.	6 oz. currants.
	½ oz. salt.

Prepare the ferment by whisking together all the ingredients in a jam jar or other suitable vessel, and placing this in a warm cupboard for about forty minutes. Sift the flour, and then rub the butter and lard into it. Make a bay, into which place the sugar; sprinkle the currants over the flour. When the ferment is ready, stir it well, and empty into the bay; make all up into a dough, using no liquid except that in the ferment. This dough must be perfectly smooth and free from scraps. Slightly warm a pan, and dust with flour; place the dough in this and cover over with a bag, and allow it to stand in a warm cupboard for

Making the Ferment.

about forty minutes. It will then be found to be in full proof, when it must be turned out upon the board, well kneaded, and then allowed to prove for another thirty minutes. At the end of this time the dough will be ready for dividing up. Weigh into 6-oz. pieces, halve these and hand up lightly, and place about four in a row on warmed greased baking sheets. Allow to prove in a warm cupboard which contains only sufficient steam to prevent a skin forming on top of the buns. Prove to about double their original size, and bake in a hot oven at 450° F., noting carefully, however, that they are done sufficiently by trying them at the light-coloured parts at the sides (about eight minutes is sufficient time to bake them thoroughly). Bake to a rich colour. On removing the buns from the oven, wash over with bun wash made from ½ pt. milk, 2 eggs, and sufficient sugar to sweeten. A large quantity of sugar must not be added, as this will make the buns sticky. Syrup may also be used as bun wash, if preferred. It is made by boiling together for a few minutes 3½ lb. lump sugar and 1 qt. water, and may be kept in stock to use as required. Another method of washing them over is by breaking two eggs into a basin, stirring these well together with a wash brush, and washing over the buns before proof and again before baking. The latter operation must be done with a soft camel-hair brush, or, failing that, with a piece of soft paper folded and cut several times to represent a brush, and the washing must be done very gently to prevent the proof being destroyed. The following is another method for currant buns:—

Making Dough and Proving.

Baking Temperature for Buns.

Prepared Egg Wash.

Syrup for Egg Wash.

Method of Flipping when in Proof.

Rich Penny Bun.

Ferment as given for first method.

Dough

4¼ lb. flour (English patent).
10 oz. butter.
6 eggs.
¼ lb. orange peel.
6 oz. currants.
¾ lb. sugar.
½ oz. salt.

Prepare the ferment and dough as for the previous mixture, scale at the same weight, wash over with egg before baking, and place a thin piece of orange peel on each: or they may be dusted over with castor sugar only instead of glazing.

A third method for currant buns is as follows:—

Royal Currant Bun.

Ferment as described for first method.

Dough

4¼ lb. flour (English patent).
¾ lb. melted butter.
10 oz. castor sugar.
4 eggs.
8 yolks.
¼ lb. lemon peel.
6 oz. currants.
½ oz. salt.

Prepare the ferment as for the other currant buns. For the dough sift the flour and make a bay, add the sugar and eggs with the ferment, and make all up into dough. Give this a good beating; carefully work in the warmed clarified butter until the dough is smooth and tough; then mix in the fruit. Store this dough away until ready for a little over an hour, then scale off at 2¼-oz. pieces. Hand these up and place upon greased warmed baking sheets, and prove with little steam. Before baking, wash over with egg, and place some sugar nibs on the top of each. (See Plate, FERMENTED BUNS, Nos. 15, 17.)

Clarified Butter in Buns.

MINCE BUNS

Prepare a dough as for currant buns (third recipe above), leaving out the fruit. Scale off in 2¼-oz. pieces, roll round, and then turn each piece over upon the board previously dusted with flour. Slightly flatten the dough with the hand and place a piece of Banbury meat in the centre of each piece, and fold over as for dough nuts. Keep them perfectly round, place upon greased baking sheets, and prove with little steam. When half proved, take a sharp knife and make five or six cuts around the border of each bun. Finish proving, bake in hot oven, and wash over with bun wash; before this dries, dust some granulated sugar over the top of the buns.

Mince Buns.

LEMON TEA BUNS

Prepare these buns by following the same method as for the mince buns, but flavour the dough with essence of lemon, and add a small teaspoonful of lemon curd to each in place of the Banbury meat. The shape of these buns may be varied by rolling them long with a point at each end and about 1¼ inch wide. When half proved, one cut is made in the centre of the top of each lengthways. They are as before washed over with egg, and again with bun wash when baked, and some granulated sugar is spread over their tops. These buns are sold at a penny each.

Lemon Tea Buns.

Lemon-shaped Buns.

SWISS BUNS

Ferment as for buns already given.

Dough

4¼ lb. flour (English patent).
¾ lb. lard.
½ lb. sugar.
Essence of lemon.
Egg colour.
A little powdered cinnamon.

Prepare the dough with ferment as used for the other buns, only add a little colour to give the appearance of eggs. Scale in 5½-oz. pieces, halve these, and roll round in the usual way; then cover with a warm cloth for five minutes. Prepare some warmed greased baking sheets, roll each piece

of dough out pear-shape about 3 in. in length, and place these on the baking sheets in groups of six or seven as required, arranged in a circle (see Plate, FERMENTED BUNS, No. 16), so that the points of the pieces come together in the centre. Wash over with egg or milk, slightly dust with castor sugar, prove with little steam in a warm cupboard, and bake in a hot oven. Upon taking these from the oven splash them over with bun wash.

Water Icing for Buns.

Another method of making these buns is to roll them out to a length of 4 in. all the same thickness, and place them about ½ in. apart upon greased baking sheets. When baked and almost cold, brush over the tops some warm-water icing, prepared by mixing fine pulverized or icing sugar with warm water into a stiff paste. This sugar paste runs smooth when spread on buns. (See Plate, FERMENTED BUNS, Nos. 1 and 4.)

BATH BUNS

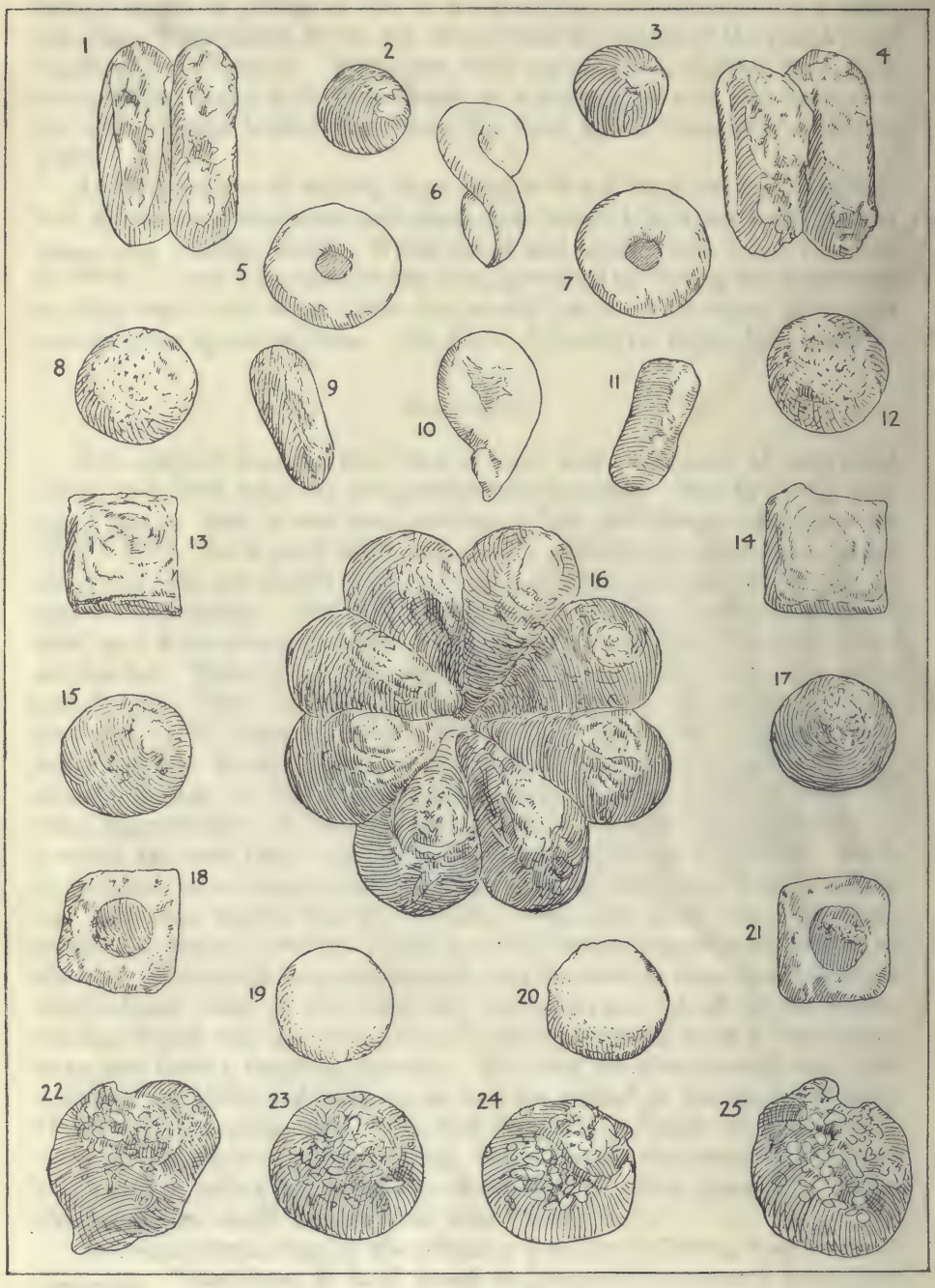
Cheap Bath or London Buns.

It frequently happens that buns of some sort are wanted at very short notice, and Bath buns are not infrequently specified. The following mixture is one that produces a bun that keeps soft and moist for a good time, and is very suitable for shop trade where customers will not readily pay more than a penny and yet expect a large bun for this money. Mix well 8 lb. rather soft flour, 2 oz. bicarbonate of soda, and 4 oz. cream of tartar. Into this flour rub 1½ lb. lard or other neutral fat. Make a bay and weigh into it 1½ lb. sugar, 1 lb. cake crumbs, and 8 eggs. Place round the outside of the flour 1¼ lb. orange peel, cut fine, and 1¼ lb. sultanas. Make all into a dough with 2 quarts buttermilk. Should there be any fermented dough left from a previous bun-mixing, it may be broken down amongst the milk and mixed with the other ingredients in the dough; such addition is a decided improvement in keeping the buns longer soft, although they keep moist without it. There is, however, an advantage in being able to use up bun dough in this way, if less had been needed for the ordinary fermented goods than the usual mixture produced. After the dough is made it can be immediately dropped on the tins. The dough is somewhat soft, and the buns in consequence are not weighed and rolled in the usual way, but pieces are cut off by the fingers the size of each bun and dropped on the greased baking sheet in such a way as to give them a rough appearance. The buns are then washed over with a strong egg glaze, and some sugar nibs are placed on the centre of each. If the dough contains any fermented dough, it is better to let the buns stand for ten minutes before baking; but otherwise they may be baked off at once in a rather hot oven, say about 460° F. This quantity of dough should produce about 8 dozen buns at one penny each.

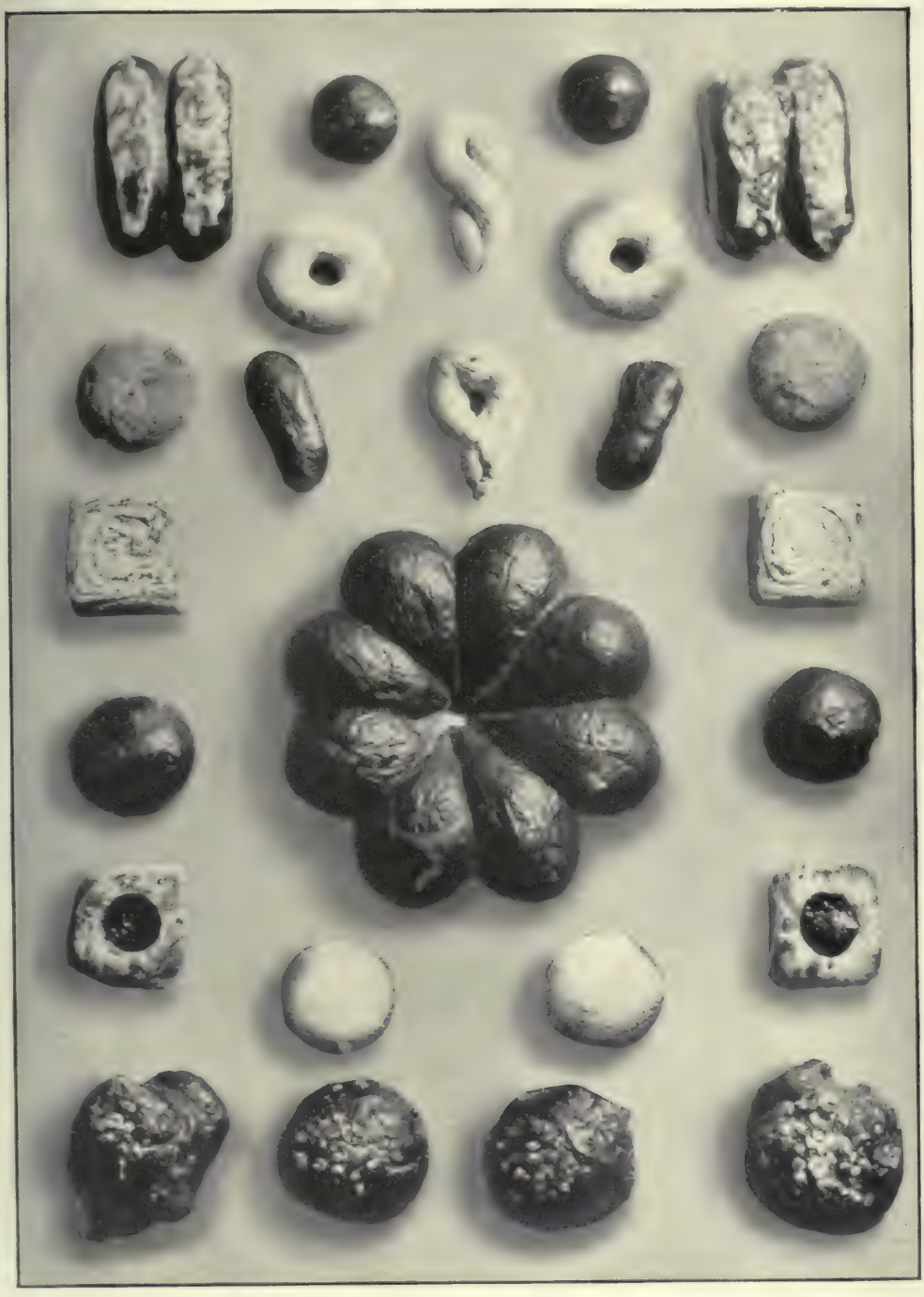
Fermented Bath Buns.

For penny Bath buns of the ordinary kind the following may be used. Take about 6 lb. of dough as prepared for currant buns (first recipe), and when half proved, work into it 1 lb. sultanas, ½ lb. currants, 4 oz. orange peel, a few eggs, or yolks and eggs mixed together,

FERMENTED BUNS



1, 4, Iced Buns or Queen's Rolls. 2, 3, Small Tea Buns. 5, 6, 7, 10, Crullers or American Dough Nuts. 8, 12, Berlin Pancakes or Dough Nuts. 9, 11, Tea Fingers. 13, 14, Chelsea Buns. 15, 17, Currant Buns. 16, Swiss Bun. 18, 21, Raspberry Buns. 19, 20, Snowballs. 22, 23, 24, 25, Bath Buns.



FERMENTED BUNS

and tighten the dough up with scone flour. Allow to lie for 30 minutes, break off in pieces about 2½ oz. each, and shape up upon baking sheets about four in a row. Wash over with egg, place some sugar nibs on top, prove slightly, and bake in a sharp oven. When they are baked splash them over with bun wash.

In good neighbourhoods and in high-class restaurants a much richer bun is required. The following may be used for buns to sell at 2*d.* each:—

Ferment as already given.

Dough

Rich Restaurant Bun.

4 lb. flour (English patent).
1¼ lb. butter.
½ lb. sugar nibs.
6 oz. sultanas.
¼ lb. mixed peel.
6 eggs.
12 yolks.
A pinch of yeast.

Sift the flour on to the board, rub the butter into it, make a bay, and place in the centre the eggs and yolks, together with the usual ferment. Make up a medium stiff dough. Allow this to lie for one hour in a warm cupboard, then return it to the board and chop in the sugar nibs and mixed fruit with a scraper. Place all back again in the cupboard to rest for twenty minutes; turn it out again upon the board; break off pieces about 3 oz. each and place upon greased baking sheets. Wash the tops with egg, sprinkle on some sugar nibs, and prove for a short time in a warm dry cupboard, bake in hot oven, and splash with bun wash.

Method of Mixing Bath Buns.

Another method of making these buns is to add part of the eggs to the ferment, make the dough up without fruit, add castor sugar instead of lump, hand them up round and wash with egg wash thin, then sprinkle some castor sugar over before baking. This is the form of bun that finds favour in the city of Bath now.

The necessity for mixing the sugar nibs and fruit after bun dough is half proved may not be very apparent, but it is done because it is important that the sugar nibs should remain as nibs, and not be dissolved as long as fermentation is proceeding; otherwise so much sugar prevents the yeast from working altogether.

Imperial Bath Bun.

A richer Bath bun than the above, and one that gives satisfaction, is made as follows. 1 quart of milk and 1 quart of water is heated up to 104° F., and 4 oz. sugar and 7 oz. yeast dissolved in it; then 1 lb. moderately strong flour is thoroughly mixed and well aerated by stirring with a whisk. This ferment should rise well in the jar and drop in about 25 minutes. Dough is made with 9 lb. English-milled patent flour, into which has been loosely rubbed 1¾ lb. sweet butter, all the ferment, 1 dozen eggs, and a few drops essence of lemon. The dough is allowed to stand covered up in a warm place for one hour, then 4 lb. sugar nibs, 1¼ lb. orange peel chopped very fine, and 1½ lb. sultanas are worked

into the dough. It is then ready for dividing into buns and placing on baking sheets. As this dough is moderately firm, it is not so suitable for breaking out in pieces with the fingers, but it can be conveniently weighed in large pieces, say 5 lb., then cut out in 30 pieces in a machine, if such is available. If not, each pair of buns will be 5½ oz. Each piece is then torn into smaller pieces on the baking sheet to give it a rock-like appearance. The buns are given about 15 minutes proof, and are then glazed with a strong wash consisting of yolks and a little water well mixed, so that the grain or fibre of the former is thoroughly broken. They are baked in a warm oven, and care must be taken that they are not overbaked, as there is a danger with such a large quantity of sugar in them that this sugar will run out at the bottoms of the buns and produce a black hard crust of a bitter taste. When this happens the buns become very hard when stale, but if only sufficiently baked in an oven not overheated at the sole, they keep soft and moist, and are altogether satisfactory. (See Plate, FERMENTED BUNS, Nos. 22, 23, 24, 25.)

Cause of Bath Buns Hardening.

JAM BUNS

To obtain variety in buns, jams of various sorts may be used as centres in the following manner. Make a ferment in the usual way with 1 qt. half milk and half water at 100° F., 8 oz. flour, 2 oz. sugar, and 2½ oz. yeast. When this drops make dough with

Jam Buns.

4¼ lb. flour (English patent).
10 oz. butter
½ lb. sugar.
4 yolks.
2 eggs.

Prepare the dough as for currant buns. When proved sufficiently, scale off at 4 oz.; halve these pieces, hand up, and place them about 1 in. apart on greased baking sheets. Press each slightly with the hand, and place to prove in a warm, dry cupboard, free from draughts. When half proved, place upon the top of each a thick biscuit, made with flour and water, about 1 in. in diameter, and kept for use day after day; or a piece of cork may be used, and will answer the same purpose. Slightly press these on to the dough, dust the border of each bun with castor sugar, and finish proving with some steam. Bake in a sharp oven, remove the pieces of biscuit, wash the buns over with bun glaze, and when cold fill in the centre of each with some greengage jam. It will be necessary to grease slightly the pieces of biscuit or cork which may be used, so that these may be removed without breaking the buns. These buns should be square in shape, and baked to a light golden colour. Before proving in the warm cupboard, the sides of each bun should be touched lightly with the butter brush, so that they may be separated with smooth sides. (See Plate, FERMENTED BUNS, Nos. 18, 21.)

Blocks for Buns.

Baking Jam Buns.

Hot Cross Buns

A very satisfactory hot cross bun for Good Friday trade is made as follows. Make a ferment as already described with 14 oz. yeast, 1 lb. sugar, 3 lb. flour, 2 qt. milk and 4 qt. water at 104° F. When this is dropped, make dough with 25 lb. flour, 4 lb. sugar, 4½ lb. lard, 16 eggs, 3 lb. currants, and ½ oz. essence of mixed spice and 1½ oz. salt. The buns are cut out and rolled in the usual way, and allowed to prove for some time dry before being docked with a cross (figs. 25 and 26). They are then glazed with egg wash and proving is finished in steam if possible. The buns look creamy-yellow in crumb, and are much better without any egg colour.

Special Hot Cross Buns.

Fig. 25.—Hot Cross Bun Docker (vertical)

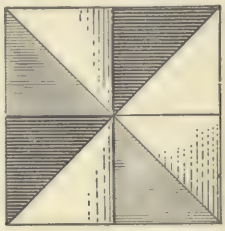


Fig. 26.—Hot Cross Bun Docker (end view)

Chelsea Buns

A popular bun in English confectioners' shops—but, it must be confessed, not so popular as it was at one time—is that known as the Chelsea Bun. This is more difficult to make nicely than the ordinary bun, but if good materials are used, and care taken, it is very nice to eat. A ferment is made as for ordinary buns, then the dough consists of—

Chelsea Buns.

- 4½ lb. flour (English patent).
- ¾ lb. butter.
- ½ lb. sugar.
- 4 eggs.
- 8 yolks.
- ¼ lb. currants.

Sift the flour and rub in ½ lb. of the butter; make a bay, place in it half of the sugar, add the eggs, and then with the ferment, when ready, make all up into a smooth dough. Allow the dough to lie until fully proved, then divide it in two pieces and pin each out to an oblong shape about 18 in. long, 12 in. wide, and ½ in. thick. Take the remainder of the butter, which should be quite soft, and brush half of this over each piece of the dough; sprinkle on the sugar and the currants, dividing these between the two pieces of dough, and spread them over the butter. Fold the dough over as when turning puff paste; pin it out again, finishing at about the same thickness and width; brush over the remainder of the butter, wet the edges with egg wash, and carefully roll up as for Swiss roll. The rolling up must be carefully done, or else a few badly-shaped buns will be the result; brush some clarified butter or lard over the dough, and cut it up into pieces scaling at 2½ oz. each, about ½ in.

Method of adding Butter, &c.

thick; lay upon greased baking sheets, cut edge down, within ½ in. of each other, and prove in a warm cupboard with very little steam. When sufficiently proved, and the pieces of dough are touching, wash over with milk, slightly dust with castor sugar, and bake in a hot oven. When baked, and while quite hot, dust over with fine pulverized or icing sugar. As these buns are baked close together, care must be taken that they are thoroughly done. This is best seen by separating some of the outside ones and noting the condition of the sides of some of the buns in the centre of the baking sheet. (See Plate, FERMENTED BUNS, Nos. 13, 14.)

Baking Chelseas.

DOUGH NUTS

Dough nuts belong to the bun class, but are boiled, or rather roasted in fat, instead of being baked. We speak of fat boiling, but it does not boil; the ebullition noticed when it is heated only lasts as long as it contains any water. For dough nuts, then, prepare some plain bun dough as already described, and when ready, scale off at 5 oz. per pair and hand up. Turn the pieces of dough over upon the board, slightly flatten with the hand, place some raspberry jam in the centre, and fold each carefully to enclose the jam. Prove these upon a bag or cloth placed upon a baking sheet in a warm cupboard without steam. When ready, fry them to a light colour in some hot lard, then drain them on a wire tray. Roll in some castor sugar. Dough rings may be made from the same dough, handed up, pinned out, and the centre of each cut out with a small plain cutter before proving. Care is necessary when preparing the lard for frying to ascertain when it is hot enough. To this end throw a few drops of cold water on the hot fat; if ready for frying—that is, if it is hot enough—it will give off a crackling noise; if not hot enough, this noise will not be produced, and the pieces of dough must not be placed in it. On no account wait until smoke is seen to arise from the fat, as this will indicate that it is beginning to burn, which will not only give the dough nuts a bad colour, but will prevent them growing while cooking to their full size; then the fat will be useless for frying a second time on account of the bad colour.

Dough Nuts.

Ring Dough Nuts.

Test for Heat of Fat.

Burnt Fat.

The ring form of dough nut mentioned above is in imitation of the American cruller, but this cake is usually made from a dough aerated by soda and cream of tartar. The following mixture produces an excellent cruller. Into 4 lb. of soft flour sift thoroughly 1 oz. of bicarbonate of soda and 2 oz. cream of tartar. Rub into this 8 oz. sweet butter or lard and make a bay, into which weigh 8 oz. castor sugar. Make a firm but smooth dough with 4 eggs and 1 pint milk. Allow this to lie for a little to lose its toughness, then pin out half at a time into a sheet about ½ in. thick and cut out with a ring cutter, or, alternatively, cut the outer circumference with a plain cutter about 3 in. in diameter, and then with a 1-in. cutter cut out the centres of the larger pieces.

American Crullers.

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